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QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment.

The Current Issue.

CONTINUING his interesting review of the development of the sugar industry in Queensland since federation, Mr. Easterby tells the story of the establishment of the Central Mills at Babinda and South Johnstone. The second instalment of Mr. Currie's account of the Brown Cutworm, together with two fine plates in colour by Mr. Helmsing, are in this issue. Mr. McGrath discusses the position and the conditions of the dairying industry in this State, and reminds us of its national importance at the present time. Mr. George Williams has a note on some manurial experiments with pineapples. Mr. Rudd has an informative article on Contagious Abortion; while Mr. Shelton gives an account of the activities at the recent Winter School for Pig Farmers. Mr. Wells's report on the work of the Callide Cotton Research Station, in an abridged form, is also published. The recent tour of a party of New Zealand farmers through a portion of South-eastern Queensland is described briefly. Some points in rural domestic economy are discussed by Mr. Bosworth, of the Queensland Agricultural College. Notes on the care of calves are supplied for the information of the young farmer. The Home and Garden section also contains a budget of topical and useful information. Taken all round the August Journal covers a wide range of matter of interest to all engaged in our basic industries.

The Governor's Speech.

SOME interesting references to rural industries were made by His Excellency the Governor, Lieutenant-General Sir John Goodwin, when opening the second session of the twenty-fifth Queensland Parliament. Referring to the measures of biological control of the prickly-pear pest, he said that so gratifying had been the success which had attended the administration of the prickly-pear lands of the State that the expenditure of the Prickly-pear Land Commission might now be considerably reduced. The present law made provision for an annual vote of £100,000 for the work of the commission. As that amount would not be required in future, a Bill would be introduced to reduce the amount to anticipated requirements.

Pear-destroying insects had done remarkable work, large areas once densely infested with pear being nearly cleared. To such an extent was that the case that notice of resumption for agricultural and mixed farming settlement purposes,

under the Prickly-pear Land Acts, had already been given in respect of thirty-three prickly-pear leases near Chinchilla, while similar action was being considered with regard to other prickly-pear leases comprising agricultural lands in close proximity to railways.

Forestry Problems.

HIS Excellency added that the forestry problems of Queensland had received very close attention. The rapid increase of importations of timbers had reacted heavily against the native forest and timber industries, whose operations had been at low ebb during the year. With a view to alleviating the situation, substantial rebates in the price of raw material from the State's forests had been made, and the assistance of the Federal Government towards safeguarding our timber industries against the dumping of cheap timber into the State had been sought.

The forest service through its prolonged experimental silviculture had demonstrated that valuable timber species could be reproduced in commercial plantations—a realisation not previously attained by any other country in the Southern Hemisphere—and silvicultural research abroad by specialists of the Queensland Forest Service substantiated the expectations of the Forestry Board in that regard.

Research into the problem of wood-taint in butter had been conducted with satisfactory results for Queensland pine, and investigations were being pursued into local shipworm-resistant timbers for use in wharfing.

Water Supply.

REFERRING to work in connection with water supplies, the Governor said that the Inkerman irrigation area had made further progress and there are now 198 farms, aggregating 6,000 acres, under irrigation. The value of irrigation for sugar-cane production could be judged by the fact that last season the average at Inkerman was 27 tons to the acre compared with an average of 18 tons for the State.

The artesian boring branch of the Irrigation Department was chiefly engaged during the year on the construction of trust bores. Whynot bore, which is situated on the Grey Range near Quilpie, was sunk to a depth of 3,290 feet, and an artesian flow of 925,000 gallons per day was obtained. This bore will serve approximately 130,000 acres of leasehold land, and the water will travel 66 miles of drains.

The Sugar Industry.

MENTIONING matters in connection with the sugar situation in Queensland, the Governor stated that the quantity of raw sugar manufactured in Queensland last season—503,000 tons—was the second largest in the history of the State, being only 3,000 tons below the record output of the previous season. Exports totalled 197,000 tons, the average return to the producer for the total output being £20 5s. 10d. per ton compared with £20 17s. 11d. for the previous season. Present indications point to the yield of Queensland sugar for the current season being in the vicinity of 480,000 tons. Hopes were entertained that the forthcoming Imperial Conference would be able to arrive at an arrangement which would secure the retention of the reciprocal benefits of inter-Empire trade.

An Excellent Season—Crop Extension.

HIS Excellency, in referring to other rural activities, remarked that in the agricultural districts an excellent season had been experienced. There had been an increase of at least 15 per cent. in the volume of wheat production.

Satisfactory reports had been received respecting this year's tobacco crop at the Mareeba Tobacco Experiment Station. The Commonwealth Tobacco Investigations Committee, working in conjunction with State authorities, had extended exploratory plots into Central Queensland. It was proposed during the coming season to extend tobacco experimental work in Southern Queensland. Data published by the Council for Scientific and Industrial Research showed conclusively that Queensland had a promising future for the production of high-class smoking tobacco.

The cotton crop for the present season was expected to be substantially larger than the preceding one. Important developments in the cotton-growing industry of the State had also marked that period, and through the efforts of the Government the cotton-growers now operate their own ginneries and oil-mills.

Favourable seasonal conditions during the past year were reflected in the output of dairy produce, which reached a new record of over 76,000,000 lb. of butter and over 15,000,000 lb. of cheese.

The Passing of Mr. Pritchard.

THE death of George Henry Pritchard removed recently one of the ablest and hardest fighters for economic rights that the sugar industry in Queensland has had in the course of its long and eventful history. To meet Harry Pritchard, in friendly or hostile conference, was to meet a man ready to fight all the way, and to fight keenly, cleanly, and with all the force of a dynamic personality endowed with rare perception and appreciation of the facts of the case, in any cause that he espoused. With him as an advocate whether in court, conference, or the Press, the industry was well served. The best part of his life was spent in waging the battles of the sugar-growers in any field into which they were taken. As an authority on sugar organisation and legislation he was recognised by all sections of the industry. His early banking training stood to him well in the wider commercial world, and his grip of every phase of the industry, in all its altering circumstances, enabled him to set a course, as events demanded, with sanity and sagacity and success. His helmsmanship in the industry was marked by strength of mind and character that won him the respect even of "his friends the enemy," who paid willing and generous tribute to the high qualities, personal and otherwise, that he possessed. His passing is sincerely regretted not only by sugar producers, but by all interested in the things that matter in this young Commonwealth, as well as by those who knew him, and having known him appreciate the value of his devotion to the industry and the State he served so well.

The Dairy Industry—The Need of Scientific Research

THE urgent need of initiating investigations into Australian dairying problems has been pressed on the Commonwealth Council for Scientific Research. On examining the request, it became obvious to the Council that a considerable diversity of opinion existed as to the lines such an inquiry should follow. The Council therefore determined to seek further information before taking definite action. From a preliminary investigation, undertaken by Professor S. M. Wadham, of the University of Melbourne, much useful information has been obtained. His report is now before us, but in making it generally available the Council indicates that such action does not mean that opinions expressed by the investigator are necessarily its adopted views, nor that it is intended to follow in their entirety the recommendations made. Professor Wadham covered a wide economic range, right from the pasture to the pantry, in the course of a brief though comprehensive review. His general conclusions and recommendations are worth the attention of everyone engaged in the dairying industry. On the economic aspect, he says that no matter how much money and effort are spent on the scientific side of an industry, such outlay will be largely in vain if the organisation of that industry is unsound. Of these economic inquiries, the first is that of land tenure—this is a regional trouble, not very old in Australia; it will spread unless it is checked at an early date. The specific information required is the extent and conditions of short term land-tenure systems in the dairying districts of Australia and their influence on dairy production as far as it can be estimated. The next point is the distribution of dairy factories in districts with reference to overhead costs of manufacture, costs of transportation, and the natural limitations preventing the regrouping of factories. The last economic problem is a survey of the overseas market and the factors operating thereon. If the Commonwealth is to have an economics bureau, he believes, the first two of these should be well within its sphere of action. The co-operation of State Departments would, no doubt, be obtained. It is possible that the Department of Markets could undertake the third, or it may actually have the information at the present time.

On the production side, his opinion is that the industry needs assistance in six directions. As to veterinary and nutritional problems, these have already been reported on to the Council. As to pasture and pasture management, it is understood that plant introduction is already receiving attention from the Council's Division of Economic Botany. A broad pasture survey of the various dairy districts in the Commonwealth, coupled with carefully devised schemes of experimentation on management and manuring, will lead to satisfactory results. The field is vast; if the Council can provide additional agrostologists for the task, so much the better.

As to herd testing and the encouragement of the use of high-grade stock, these are matters which can be treated adequately by State Departments. The importance to the industry of subsidiary products, such as pig-raising, is great and requires careful study. It is in some ways a local problem and, requiring extensive areas and buildings, must remain a matter for State organisation. Professor Wadham also discusses educational and technical matters, and all his recommendations as to the training of factory operatives, technical control, and continuous research are worthy of every consideration.

THE QUEENSLAND SUGAR INDUSTRY.

By H. T. EASTERBY, Director, Bureau of Sugar Experiment Stations.

PART VIII.

(b) Review of the Industry since Federation.

(Continued.)

WE may now proceed to the establishment of the Central Mills of Babinda and South Johnstone, as they were the outcome of the Report of the Royal Commission which was appointed late in 1910 but did not take the bulk of its evidence till 1911. This Commission was appointed by the State Government to inquire into and report upon the following matters relating to the sugar industry, i.e.:—

(1) Is it desirable that the Government should establish more Central Sugar Mills?

(2) If so, how many and where?

(3) What conditions should be imposed on advances to be made for the erection of such mills?

The Commission consisted of Messrs. R. A. Ranking, Police Magistrate, J. R. Paddle, and Dr. A. J. Gibson.

Applications for the establishment of Central Mills had been received by the Government from Babinda (Russell River), Bailey Creek and Daintree River, Daradgee (North Branch of Johnstone River), Freshwater (Cairns), Liverpool Creek, Tully River, Rockhampton, and Gympie and later on instructions were sent to visit Aloomba (Cairns), South Johnstone, Mourilyan Syndicate lands, Long Pocket (Ingham), Hamilton, Kelvin Grove, Silent Grove (Mackay), and Yeppoon (Rockhampton). After visiting the various sites proposed for Central Mills and hearing a large amount of evidence, the Commission recommended—

(*a*) That it was desirable that the Queensland Government should establish more Central Mills.

(*b*) In connection with the question of how many new mills should be built the Commission took into consideration the then milling power of the existing mills, the importation of foreign sugar and the possible increase in population. They pointed out that the average annual production for the years 1902-1909, inclusive, amounted to about 160,000 tons, and that the average annual imports of foreign sugar for home consumption for the years 1901-1910, inclusive, amounted to 46,306 tons, and they took this import of 46,306 tons as the actual average annual shortage as between production and consumption. They considered that the increase in population would indicate an increased demand of approximately 3,500 tons of sugar per annum. At the same time expansion in the existing mills and the possible erection of mills by private enterprise was not lost sight of, nor the fact of variable seasons, although this factor to-day with the much greater production north of Townsville is not of so much importance.

Allowing for such factors the Commission recommended that two mills should be erected for the crushing season of 1913 and one for the year 1914, and that the consideration of the erection of additional mills

be thereafter reviewed as necessity arose and in the light of their final recommendations as to sites. After reviewing the different sites inspected, the Commission recommended that the two mills to be erected for 1913 should be one of 10,000 tons and one of 5,000 tons sugar capacity. The larger of these mills should be erected at Babinda Creek, Russell River, and the smaller mill at Daradgee, Johnstone River.

In considering the proposal to erect a mill at Jarvisfield, near Ayr, the Commission reported favourably, but Mr. J. Drysdale, of the Pioneer Mill, in giving evidence stated a verbal agreement between himself and the Government existed whereby he was to erect a mill on the Inkerman Estate, and he further stated that he intended building this mill, not only to met the requirements of the Inkerman lands but to take surplus cane from the Pioneer and Kalamia mills. The Commission therefore recommended that if before 31st December, 1911, no definite assurance had been received by the Government that a sugar-mill was to be established at Inkerman, the number of mills to be erected for the 1913 season should be three, the third mill of 5,000 tons capacity to be built at Jarvisfield, Burdekin River.

Continuing with their recommendations the Commission advised that for the season 1914 a mill of 8,000 tons sugar capacity be erected on the south branch of the Johnstone River, and that the subject of the further erection of central mills should be allowed to remain open to review by the Treasurer from time to time. If further new mills were decided upon, the Commission put the sites for same in the following order:—

Freshwater (Cairns), Liverpool Creek, Tully River, Long Pocket (Ingham), Bailey Creek, Hamilton (Mackay), Silent Grove (Mackay), Aloomba (Cairns), and Don River (Bowen).

The Commission further recommended under the provisions of "*The Licensing Act of* 1885," section 22, the prohibition of the issue of new licenses for the sale of liquor within the area for proposed new mills.

The outcome of the Commission's Report was the passing of an Act in October, 1911, to authorise the construction and establishment of sugar works by means of moneys advanced by the State and to provide for the repayment of such moneys, and for the maintenance, management, and control of such sugar works and for other purposes connected therewith. This Act was known as "*The Sugar Works Act of* 1911," and it was under this Act that the Babinda and South Johnstone sugar-mills were erected by the Queensland Government. The Act provided for a system of Cane Credits, being a percentage of the price paid by the Corporation of the Treasurer to suppliers of cane as the Corporation considered to fairly represent money appropriated towards the repayment to the Treasurer of the loan with interest, and also provided for rates on owners and occupiers of land within a sugar-works area to meet any annual deficiency. The sale of intoxicating liquor in a sugar-works area (i.e., a sugar-works area created under the Act) was declared to be unlawful.

The recommendation that two mills be erected for 1913 was not carried out in that year. The Daradgee proposition eventually dropped out. Messrs. Drysdale Brothers, however, erected the Inkerman Sugar Mill in 1913-14, and its first crushing took place in 1914 with a crop of 62,052 tons of cane. Due to the severe drought in the Lower Burdekin district in 1915 the Inkerman Mill did not crush that season.

In 1913 the Cairns-Babinda supporters of the mill project were getting restive. A number of growers had opened up land at Babinda and were already growing cane. From the Babinda area about that time growers representing some 480 acres were sending their cane to Mulgrave, and those representing 1,017 acres were forwarding cane to the Colonial Sugar Refining Company's mill at Hambledon. There were also areas that had been planted which were too far from Mulgrave and Hambledon to render the harvesting profitable, and in addition a number of small areas were under cane for the purpose of providing plants. Arrangements were made in April of 1913 by the Premier, Mr. Denham, to visit Babinda, where he met the Provisional Committee and a large number of those interested in the project. Most impassioned speeches were made, notably by the late A. J. Draper and G. R. Mayers, and also by Dr. Reed, who were all at that time considerably interested in the Babinda lands. Certain statements had been laid before the Government before the meeting took place, and the Premier stated that if the evidence as to areas, &c., were substantiated the next step would be to call tenders for the erection of the mill. The duty of verifying the statements was put in the hands of the writer who, with Mr. R. Wilson, now Assistant Under Secretary to the Department of Agriculture and Stock, rode around the lands interviewing the canegrowers, and the facts elicited were that the estimated area under cane closely approximated that set out by the Provisional Committee.

Later in the year tenders were called for the erection of the Babinda Mill, the successful contractors being Messrs. George Fletcher and Company, of Derby, United Kingdom. During 1914 the land was cleared for the mill site and the building partly erected, it being intended to commence crushing in 1915.

Tenders were also called for the sister mill to be erected in the South Johnstone area, and the same firm were successful in getting this contract also. This mill was to be ready to crush in 1916. Scrub clearing was commenced and farms were being taken up for the opening of the mill.

The Babinda Mill was ready for crushing during the 1915 season and got to work, although it was not finished by the date set out in the contract. This was due principally to the war and the difficulty of procuring materials necessary for the completion of the works. It was a very dry season in 1915 and there were numerous cane fires which, according to one exaggerated statement, boiled all the fish in the Russell River, but which did considerably hamper manufacture, and there were at times serious delays owing to accidents to the machinery, so that serious deterioration in the cane set in before it could be treated. As the season progressed, however, many difficulties were overcome. The first crop was naturally a small one, amounting to only 47,014 tons of cane. The sugar manufactured at 94 n.t. being 5,209 tons. The following year, 1916, however, saw much improved conditions all round, and Babinda's crop was 154,630 tons, and since that date it has always had large tonnages of cane to deal with. The contractors did not hand over the mill till after the completion of the first crushing. Meantime, the erection of the South Johnstone Central Mill had been commenced and was being proceeded with in 1915. At the end of the year owing to the war the delivery of machinery was delayed and progress much retarded. It was, however, hoped that the mill would be equipped and ready to commence crushing about the end of September, 1916. The tramway work at South Johnstone was of very solid character, caused by the country through which it was necessary to go for cane.

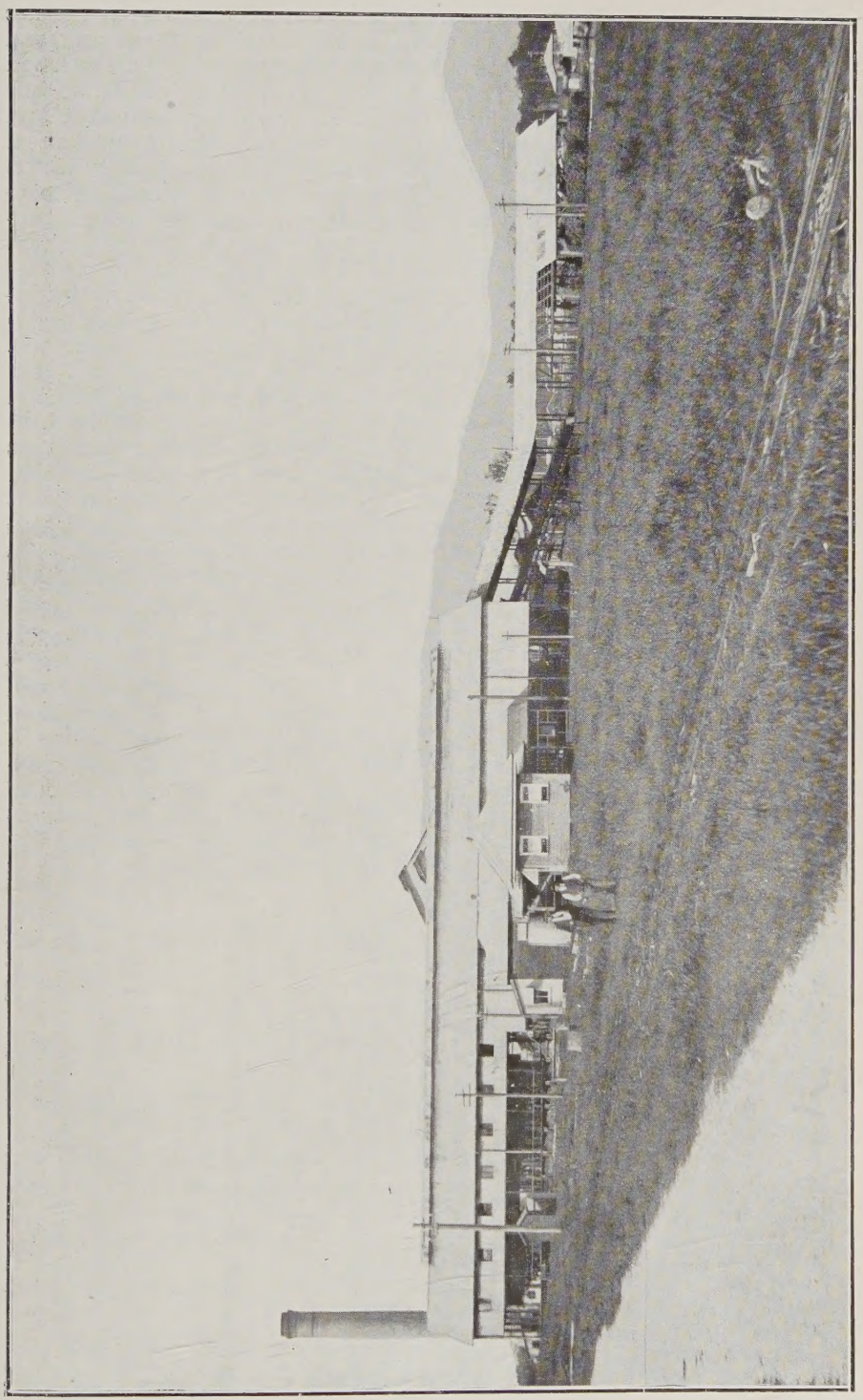


Plate 48.—Babinda Central Sugar Mill.

The mill was due to be completed in July, 1916, but it was not complete in October of that year. A start was made at the end of October and a crop of 56,205 tons of cane was put through the rollers. A good deal of the sugar introduced could not be recovered owing to the requisite appliances not being available, and the financial loss caused thereby was considerable. It was recognised, however, that the farmers were not responsible for the war conditions and that their crops must be removed. The crushing did not terminate till February of 1917 when 4,653 tons of 94 n.t. sugar had been manufactured. It took 12·07 tons of cane to make one ton of sugar. Next year, 1917, the crop was 81,584 tons. A loss was made on the first two seasons' operations, which naturally created much anxiety. Unfortunately, the following year (1918) a disastrous cyclone caused great damage to this mill, not only were buildings wrecked but there was loss of life and the farmers suffered severely, houses as well as crops being more or less damaged. In consequence, the tonnage of cane fell this year to 57,106 tons. The outlook at South Johnstone therefore in the early years of its history was most distressing, but in a few years the difficulties were surmounted and big crops have been handled during recent years. The erected of these two mills had a wonderful effect in opening up unpopulated country. Where impenetrable jungle once reigned there are now mills, townships, farm houses, schools, hospitals, libraries, post offices, telephone exchanges, and railways—in fact all the adjuncts of civilisation.

In a history of this kind it is necesary after following out different lines of activities to have to return to a previous period. We may therefore go back to 1912 when the first Federal Royal Commission concluded its sittings and presented its report. This was the most voluminous document ever printed in connection with the Australian sugar industry. Evidence was taken from 447 persons, and the printed volume ran into 1,146 foolscap pages. The findings were not quite unanimous, four of the members presenting a majority report, while a dissentient memorandum was furnished by Mr. T. Crawford, one of the members. The reference to the Commission embraced the following subjects:—

(*a*) Growers of sugar and beet;
(*b*) Manufacturers of raw and refined sugar;
(*c*) Workers employed in the sugar industry;
(*d*) Purchasers and consumers of sugar;
(*e*) Costs, profits, wages, and prices;
(*f*) The operations of the existing laws of the Commonwealth affecting the sugar industry; and
(*g*) Any Commonwealth legislation relating to the sugar industry which the Commission thinks expedient.

The Chairman of the Commission was first Sir John Gordon, and on his retirement through ill-health William Jethro Brown. The other members were Albert Hinchcliffe, M.L.C., R. M'C. Anderson, M. R. M. Shannon, and T. W. Crawford. The Commission entered on its duties on 25th October, 1911, held 139 sittings, and presented its report in December, 1912. In the conduct of their investigations and in the framing of their report they assumed:—

(1) A loyal adherence to the policy of a "White" Australia.
(2) The natural importance from the point of view of defence of effecting the settlement and cultivation of the tropical and semi-tropical areas of the Australian continent.

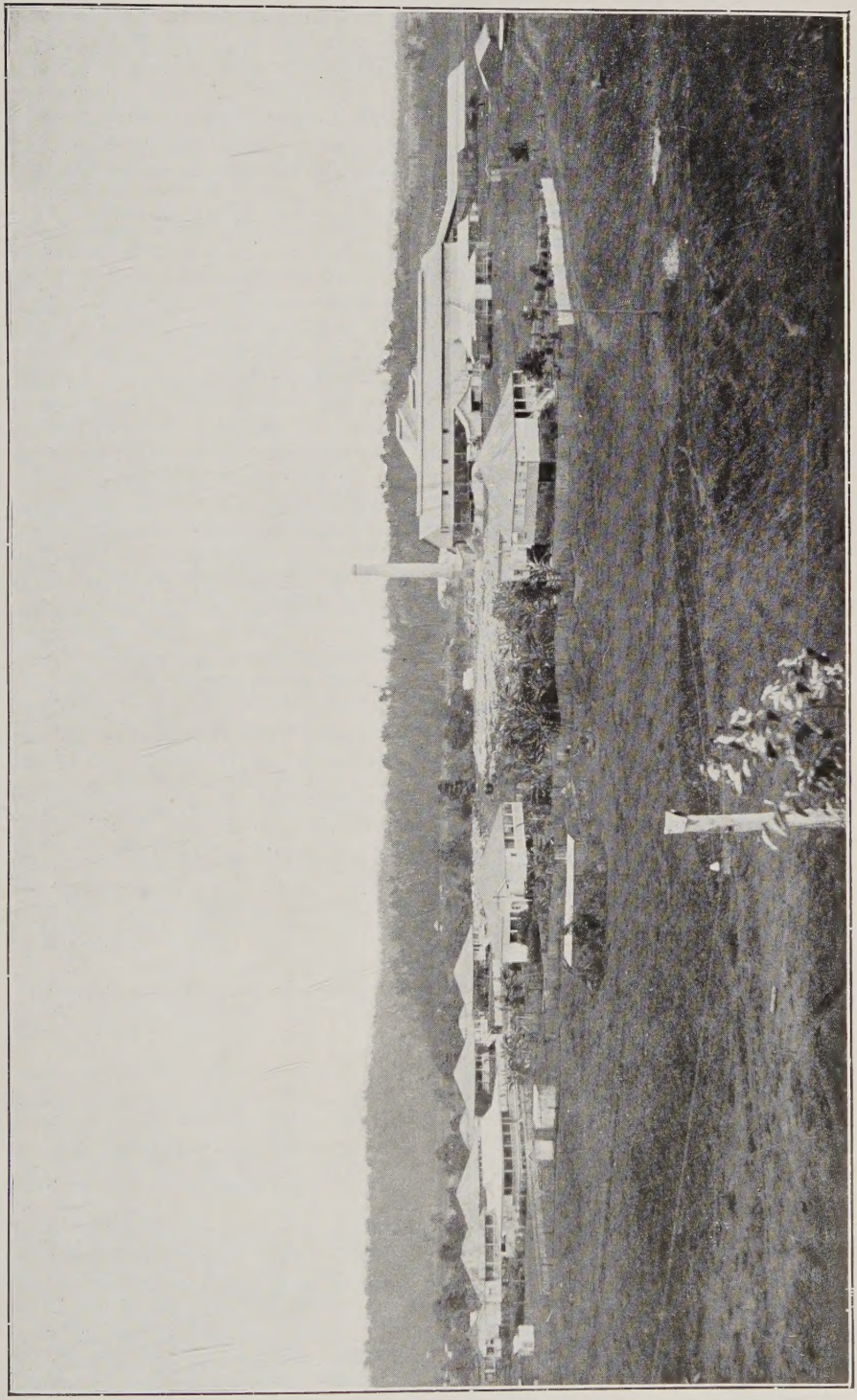


Plate 49.—South Johnstone Central Sugar Mill.

The Commission served a highly useful purpose, and its report was read with intense interest. They took a far-seeing view and to some extent dispelled the clouds of ignorance and prejudice obscuring this important industry; they showed that it was one of national importance, the maintenance of which vitally affected every citizen of the Commonwealth. By no other means could our vast littoral be peopled and defended. The following extracts from their report are worth quoting and are just as vitally applicable to-day:—

> "While the wide divergencies of opinion which exist to-day with respect to the relation of public control to the sugar industry are often the result of mere ignorance of essential data, they are still more frequently the result of the failure to out-grow ideas, opinions, or policies which belong to the limited outlook of pre-Federal times. The problem of the sugar industry to-day is not, save in subordinate respects, a problem of industry, of wealth, or of production; it is primarily and essentially a problem of settlement and defence. No nation can afford to regard lightly the development of its industries, the progres of its wealth, or the economic efficiency of its productive machinery. But, important as these things undoubtedly are, they rank, as regard the sugar industry, on an inferior plane. The Commonweatlh to-day is brought face to face with one of the gravest problems which has ever taxed the ingenuity of statesmanship—that of the settlement of tropical and semi-tropical areas by a white population living under standard conditions of life. And, intimately associated with this problem is the question of national defence. If the ideal of a "White" Australia is to become an enduring actuality some means must be discovered of establishing industries within the tropical regions. So long as these regions are unoccupied, they are an invitation to invasion as well as a source of strategic weakness. Granted so much, it follows that the supreme justification for the protection of the sugar industry is the part that the industry has contributed, and will, as we hope, continue to contribute to the problems of the settlement and defence of the Northern portion of the Australian continent. The recognition of the nature of this supreme justification is the first condition of a sound public policy in relation to the sugar industry. Relatively to it all other issues are of minor importance."

The Commission recognised at that date the possibility of effective settlement by a white population of the Queensland coastal areas. They believed the opposition shown was due to a failure to recognise the physical adaptibility of the white races to varying climatic conditions.

It is not intended to follow the report of the Commission in detail as at the present time many of the questions which were then of importance have been settled or are no longer of any great interest. It was a capable Commission and the industry owes a debt of gratitude to it for its presentation of the facts.

During 1912 the Department of Agriculture sent the late Mr. T. H. Wells to New Guinea to collect sugar-cane varieties, and 158 were forwarded to the Mackay Sugar Experiment Station. Those were secured by Mr. Wells in the face of considerable difficulties from the mountainous regions of Papua. Unfortunately, after long trials, none of those varieties were found to be as good as three or four of the earlier collection by Mr. H. Tryon, though Mr. Wells was not responsible for this, as he had no way of testing canes but simply chose them on appearance.

[TO BE CONTINUED.]

Bureau of Sugar Experiment Stations.

FIELD DAYS.

It has been the policy of the Bureau of Sugar Experiment Stations for many years past, to conduct Annual Field Days at each of the Experiment Stations, at South Johnstone, Mackay, and Bundaberg. In this way it has been possible to bring before the notice of attending growers and others interested in the industry the nature of the work which the Bureau is undertaking, and a demonstration of the results obtained.

Whilst realising the shortcomings of this field day system, the policy was continued until last year, but it has now been decided that the Experiment Station field days shall be discontinued. This may possibly meet with disfavour from sections of canegrowers who were happily situated with respect to an Experiment Station, but it is felt that a careful consideration of the plan which will be substituted for the old one, will go further towards the achievement of the full aim and object of a field day, and will exceed in usefulness and popularity those hitherto conducted at the Stations.

The interest shown in our annual gatherings of the past is evidenced by the numbers attending these functions. Last year, record numbers attended field days at all three Stations, and at Mackay the number present approximated 1,000. The difficulties which attend the efforts of the Bureau officers in their attempt to address such large gatherings, or to meet individual growers is very evident. For this reason it is desirable that the numbers attending a group field day should be greatly reduced, and the plan must be to increase the number of field days, and meet smaller groups of growers on each occasion. The Bureau will hold, then, district field days—a district consisting of the area supplying cane to one mill, or of an area which produces portions of the crop of several mills, but where soil and general agricultural conditions are similar.

The inauguration of such a scheme has been made possible by the recent addition to the personnel of the agricultural staff of the Bureau, and the decentralisation of the experimental work which is rapidly being pushed ahead. Last year marked the institution of extensive farm experimental trials, to determine the effects of fertiliser treatments, to compare the relative values of a series of cane varieties, or the resistance of new and old varieties to major cane diseases. These plots have been set out over a wide range of soil and climatic conditions, and each year their numbers will be increased.

The results gathered from these tests should be of greater direct value to growers than the results of Station experiments; for they are performed under farm conditions, on soils representative of the types on which the results will be applied directly. It is obviously futile for a grower to visit, say, the Bundaberg Station, study the fertiliser response there, and hope to obtain similar results from identical treatments on, say, the alluvial soils of the Maroochy, or even the Burnett River. Similar remarks will apply to methods of land preparation and cultivation; for a different set of conditions might render the methods employed on one soil type, under its peculiar climatic conditions, totally unsuited to a different type with its attendant problems.

Field days will, then, be conducted along lines somewhat similar to those which were followed at Bli Bli (Nambour) last year. This field day was conducted by the local farmers' committee, and the success of the project was such that the event is to be repeated enthusiastically a few weeks hence.

A plan which might prove suitable for a mill district field day would be along the following lines:—The local committee (or executive) would fix a day which is agreeable to the majority of growers, as well as the place of assembly. Officers of the Bureau representing the various agricultural divisions would be in attendance, and proceed with the party over a carefully arranged itinerary. It might be thought desirable to make a tour of inspection of fertility or varietal trials located within the mill area, and the points of value which are evidenced by the different treatments (or varieties) discussed. The extent to which the results of the trial are applicable throughout the area might be emphasised and the limitation of their application also stressed.

A practical study of the soil type from the point of view of its cultivation needs and physical peculiarities could be undertaken profitably. On an agreed farm a demonstration of suitable and improved implements could be arranged with the manufacturers and distributors of farm implements, in the same way as they have been at the Stations in the past.

Addresses on the important cane diseases and pests might also be given by the Bureau's officers. In districts favourably situated with respect to Experiment Stations, the latter might be visited if there be any demonstration of value to be seen. The smaller number of growers in the party will make it possible to encourage discussions on the various points raised, regarding all phases of agricultural work, and the personal touch between the grower and the officers will be fostered.

The advantages attending such a field day will be evident. It provides an opportunity for the officers to meet growers under their own conditions, and discuss with them their problems and the methods by which their difficulties may be met. It may not be possible to arrange field days of this nature during this year, but the wishes of growers will be met, as far as possible, in this respect. Farmers may rest assured that the officers of the Bureau will do their part in making the function one of value and interest.

In conclusion, it should be clearly understood that this is not an attempt to keep interested growers from visiting the Experiment Stations. On the contrary, visits will be welcomed from all interested in the work, either individually or in groups, and the Bureau takes this opportunity of inviting more growers to visit the Stations, when the officers will be ever ready to conduct them around and give information on subjects of interest.

CANE PESTS AND DISEASES.

The Director of Sugar Experimental Stations, Mr. H. T. Easterby, has received the following report (24th July, 1930) from Mr. J. H. Buzacott, Assistant Entomologist:—

NOTES ON THE GIANT TERMITE.

A period of five weeks spent in the Burdekin district during May and June this year disclosed some interesting facts relative to the life-history of the Giant Termite, *Mastotermes darwiniensis* Frogg.

A great number of stumps and logs infested by the pest were examined, and finally the search was rewarded in the finding of quantities of eggs. These eggs were discovered in a rotten stump, which, on being pushed, broke off level with the ground, and proved to contain almost a solid mass of termites. At ground level where the fracture occurred, there were seen attached to the earthy matrix of the internal nest, numerous groups of brown eggs, and one individual termite somewhat larger than the normal worker and quite distinct in that it was of a rich dark-brown colour with a creamy-yellow venter. This termite appeared to be actually ovipositing when first observed, but it is not possible to say definitely that it was, and although kept alive in a tin for nearly a fortnight it never oviposited therein. Thus the actual laying of the eggs still remains somewhat obscure, although it seems possible that they may be laid by a modified type of worker such as that described, particularly as Mastotermes is known to be a primitive genus.

The eggs are elongate, about .05 inch in length, of a uniform brown colour, and attached by one pole in groups of twelve to twenty-four. The units in each group appear usually to be arranged in two parallel rows and are bound together throughout their length by some sticky substance, which seems to be provided from the mouth of the worker. On the nest being opened, the workers immediately proceed to carry away the egg masses and reattach them to the nest matrix in a more secluded tunnel of the nest. On hatching from the egg, the young feed on fungi growing on the matrix where the eggs are deposited until they are capable of going out to forage with the adults.

In a nest of Mastotermes the following types can be seen:—Workers (one caste), soldiers (one caste), alate forms (winged), and nymphs of the three types. During May, however, neither alate individuals nor their nymphs showing wing pads are present. In August the latter are to be found, but the fully developed wing-bearers do not appear till October, and they usually fly in December or January. The number of soldiers present is always small compared with those occurring in other species, and although moderately agressive, the soldier does not rush to the spot when an attack is made on the nest like those of Eutermes and other species do. The soldier is provided with powerful mandibles which it is not slow to use, and, on breaking a nest, soldiers will sometimes be observed carrying the young nymphs away in their mandibles.

It is a common practice among termites to eat the bodies of their dead, and this fact is the keynote of success in using arsenicals or stomach poisons as a means of destroying nests. As far as can be determined this does not take place in Mastotermes. The dead bodies of their fellows will be collected and carried to a

disused tunnel and there left in a heap to become covered with mould. Whether the termites make any use of the mould which freely flourishes in the burial grounds is hard to state.

There are several insects which are always found in the nests of Mastotermes. The larva of a small slate-grey moth, huge larvæ of the scarabæid Xylotrupes and other smaller scarabæid grubs are found feeding on the earth and digested wood matrix of the colony. A small silver fish is common, and large centipedes and millipedes often found, the centipedes feeding on the inmates of the nest.

Many species of ants are predaceous on the termites, and if a nest be broken open most of the denizens are quickly carried off by ants, particularly *Iridomyrmex* and *Camponotus*, although several smaller genera, *Pheidole*, for instance, also do good work.

A nest may not extend more than a few inches into the ground or it may go down for several feet, and from the nest small galleries radiate through which the insects communicate with such food as small trees, sugar-cane, or other growing crops, which may be several chains away from the nest. The termites enter the cane or plant by a small hole and eat out the contents of the stick, leaving only the thin rind without external evidence of injury, until the growing point of the plant is reached, when the heart leaves die.

Practically all timbers are subject to attack by Mastotermes, but some are more resistant than others, and chief of these is Gidgee, which, on that account, is much in demand for fence posts in the Burdekin district. Leichhardt, Moreton Bay Ash, and the Black Palm are particularly susceptible, even whilst growing, to attack.

Recommended Methods of Control.

At the outset it should be stated that *Mastotermes darwiniensis* is far more difficult to control than the smaller species of termites. One of the chief reasons for this is that it does not show any sign of a mound or termitarium above ground where it nests, and every post, stump, or even tree may possibly harbour a colony. There is no means of telling without actually digging whether a tree or stump which is attacked actually harbours a nest or is communicated with from a nest located perhaps several chains away. Another factor which renders them difficult to exterminate is the fact referred to above that they appear non-cannibalistic in habit, thus greatly reducing the value of arsenical poisons as a measure of control.

With regard to buildings, posts set in concrete coming above the surface of the ground and watched to see that the termites do not build a communication gallery over the surface of the concrete is probably the best method to secure against attack. If this is impracticable, all timber used should be coated with a repellent such as creosote oil, or soaked in a 10 per cent. solution of sodium arsenite. If these are not obtainable, then timber soaked in or painted with crank-case drainings from the car or tractor, in which a little arsenic has been dissolved would prove resistant. Wherever a piece of boarding is removed on account of termite attack, the replacing board should be treated as mentioned above, and if the attacked timber cannot be removed, bore some holes into it and squirt in some of the arsenic in oil solution mentioned before.

Sugar-cane plantations suffering damage should first try and clear all timber, stumps, and logs as far as possible from the farm. It should be borne in mind that the termite probably only visits the cane for water. This is borne out by the fact that sugar-cane is always far worse attacked in dry seasons, but at the same time although a certain amount of moisture is necessary, yet an excess of water is one of the best methods of repelling the termite, and further reference will be made to this shortly. Any timber in which a nest is located should be treated by pouring half a pint of carbon bisulphide or a couple of pints of benzine into it and blocking all openings. This treatment will kill most of the inmates of the nest, and if carried out systematically will greatly lessen the pest. Baits consisting of arsenic and molasses in the proportion of 1 lb. to 50 lb. may be poured into nests and are successful, but this treatment should be varied, as after a while the termites seem to get cunning and will not take the baits.

Fence posts are very frequently the source of infection of a farm, and, where possible, the substitution of steel posts as supplied by some Southern firms would be profitable. If wooden posts must be used and Gidgee cannot be obtained, then they should be soaked in 10 per cent. sodium arsenite solution and well creosoted or tarred before putting in the ground.

As regards the cane itself, nothing is more effective than frequent heavy watering of the cane, a course which is quite practicable in the Burdekin district where irrigation is universal. This method of control has been found most effective in

controlling certain South African termites which ravage plantations, and has also been found to give good results in Queensland. Usually one side or a corner of a block shows heavier damage than the rest of the block, and when this is the case a furrow could be ploughed along the headland between the cane and its source of infestation, and in this furrow a bait consisting of bran or sawdust mixed with a little molasses or treacle and water into a mash and then some white arsenic stirred into it should be distributed, and the furrow covered over. Approximately, 1 lb. of the poison is required for 50 lb. of bait. Cane sticks containing termites should be treated with one of the above baits, by breaking off the top of the stick and pouring some of the bait down the tube disclosed.

Planting should be carried out with the ground as moist as possible, or it should be well watered after planting in order to keep the termites from attacking the young shoots, and thus causing a bad strike. Nests may be destroyed if no fumigants are available by well breaking into them, thus allowing access for their enemies, the ants, which will quickly carry off every exposed termite.

In conclusion, the termite or "White Ant," *Mastotermes darwiniensis* Fr., although not presenting a major problem like the cane grub, is steadily spreading, and even if not becoming more intense, it is affecting more farms than a few years ago. It is far better for growers to make an organised effort to control a pest while it still remains fairly easily controllable, than to let it increase its depredations until eventually it reaches such numbers as to require a great deal of time, labour, and money to eradicate it.

CANE PEST COMBAT AND CONTROL.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following Special Report, dealing with experimental work carried out during the period May to June, 1930, *against insects of the genus Pseudococcus; and which deals with the discovery of a cheap and effective method of combating our mealy bug of sugar-cane, from the Entomologist at Meringa, Mr. E. Jarvis.*

A NEW AND EFFECTIVE SPRAY FOR MEALY BUGS.

Most canegrowers and other agriculturists have experienced the persistent aggressiveness of these small, soft-bodied, pinkish insects which are dusted over or covered more or less thickly with white powder or flocculent filaments of a waxy nature. Being gregarious in habit they are usually met with in small colonies, consisting of from fifty to hundreds or thousands of individuals of all sizes, from the tiny larval to adult forms, the latter being generally less than one-eighth of an inch long. In the Cairns district mealy bugs commonly infest the granadilla, passion fruit, and many other creepers, proving particularly obnoxious also to such ornamental shrubs as Acalyphas, Ixoras, Coleus, Crotons, &c. The tropical fruit trees most badly attacked appear to be the Sour-sop and Custard Apples, the fruit being sometimes so grossly infested as to appear white instead of green. (See accompanying plate.)

In canefields these bugs congregate under the older leaf-sheaths in masses, and being thus screened from view their presence usually remains unnoticed.

Notes on Remedial Measures.

Owing to the waxy secretion already alluded to affording a defence against insecticidal sprays, the control of mealy bugs has always proved a somewhat difficult matter; seeing that such protective covering must first be dissolved in order that the bodies of the insects may be thoroughly wetted with the solution used. Moreover, many of the species have an objectionable habit of nestling as far as possible out of sight around the softer shoots and basal portions of the leaf-stalks of affected plants, in positions which can only be reached by the careful application of driving mist-sprays.

Amongst the many different remedies recorded as being more or less effective against insects of the genus *Pseudococcus* the following substances may be mentioned here, viz.:—Kerosene and soap emulsions, resin compounds, carbolic acid, nicotine, lime sulphur, oleic acid, oil emulsions, &c.

Recent experimentation carried out by the present writer at Meringa Sugar Experiment Station has aimed at the discovery of a formula which, in addition to being inexpensive and simple to prepare, shall be composed of materials obtainable at all times from every country store or grocer shop.

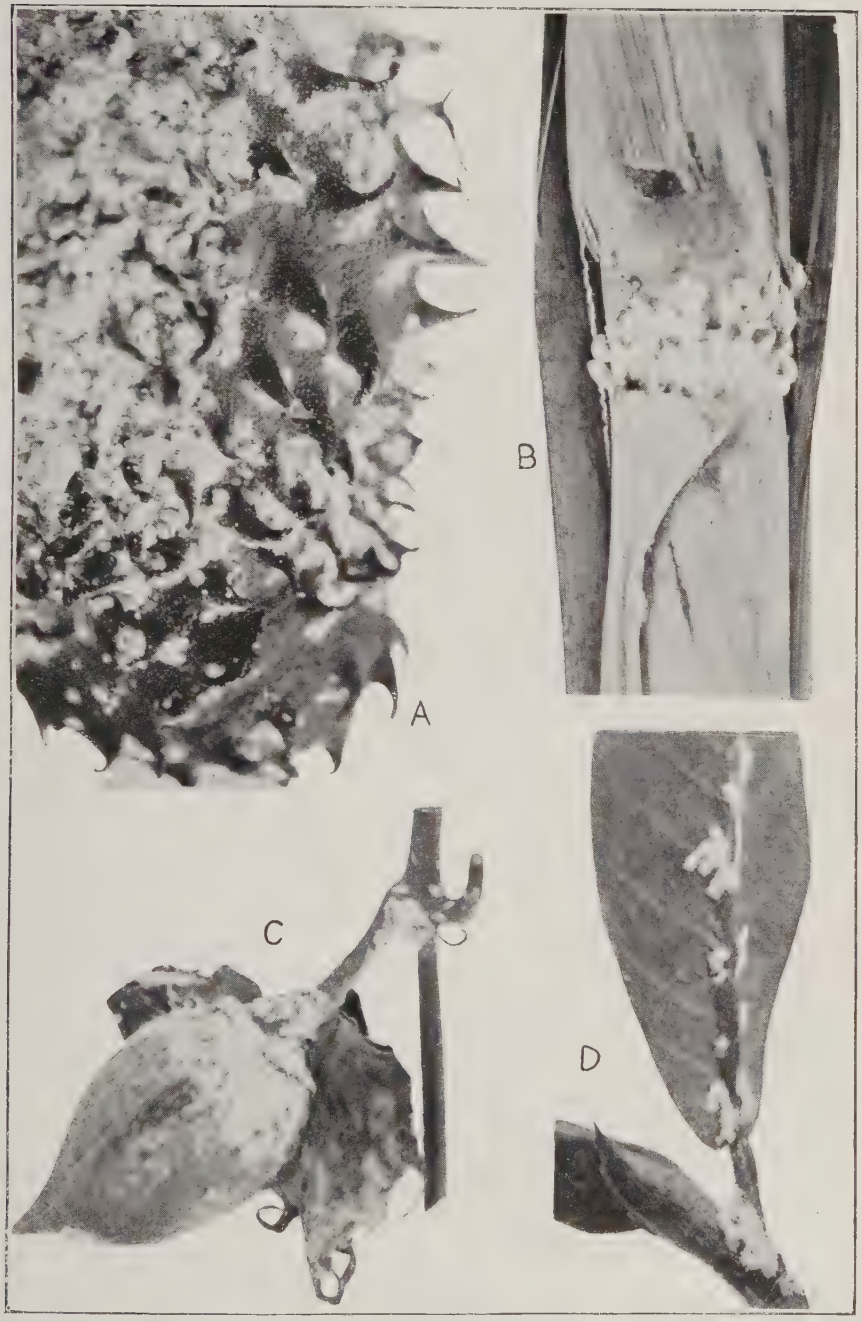


Plate 50.

A. Part of Sour Sop fruit infested by Mealy Bugs. Natural size.
B. Mealy Bugs attacking stick of sugar cane. Natural size.
C Cotton Boll, infested by Mealy Bugs. Natural size.
D. Mealy Bugs on leaf of *Ficus pilosa*. Natural size.

Attention was accordingly concentrated on such substances as caustic soda, kerosene, soap, resin, and tobacco, used either one with another, or in various combinations; my desire being to make a stock solution of firm consistency, calculated to keep well in the tropics and be always ready for use at a moment's notice.

Preliminary experiments with resin and washing soda compound are proving satisfactory, a soap emulsion containing kerosene and caustic soda was tried and found promising. This latter spray killed about 75 per cent. of adults, 100 per cent. of tiny larvæ, and all eggs that chanced to be fully exposed. Tender foliage was not injured by the solution.

Two different emulsions were then prepared on 21st May, one containing tobacco extract and kerosene, the other crude carbolic and tobacco, in proportions thought likely to combine well. This carbolic acid spray destroyed from 25 to 30 per cent. of adult mealy bugs, together with all the young larval forms; the ants in attendance on them being also killed.

Another emulsion containing caustic soda and kerosene proved fatal to about 95 per cent. of adults, and 100 per cent. of young bugs that chanced to be fully exposed to the spray.

As a result of experiments with the emulsions alluded to above, and a few additional preparations which need not be described here, it was found that maximum mortality was obtained from a combination of soap, kerosene, and tobacco.

This emulsion, which destroys practically 100 per cent. of adults, young, and eggs of this pest, including attendant ants, will now be given in detail below. The table indicates concisely the amounts of material required for making various quantities of the stock-solution.

SIMPLE AND EFFECTIVE SPRAY FOR MEALY BUGS.

Soap "Witch" bar	10 oz.	1¼ lb.	2½ lb.
Kerosene ("Laurel" brand) ..	1 pint	2 pints	2 quarts
Tobacco (black plug)	2 oz.	4 oz.	½ lb.
Rain water	3 pints	3 quarts	1½ galls.
Amount of stock-emulsion	4 pints	4 quarts	2 galls.
Total quantity of spray, if using 6 parts water to 1 part stock-emulsion	3½ galls.	7 galls.	14 galls.

The cost of three gallons of spray solution works out at about 1s. 8d. for material, exclusive of spray-pump or labour, &c. Needless to say, this amount of spray, when applied in mist form, goes a long way.

How to Make the Stock-Emulsion.

Cut 10 oz. of the soap into thin shavings, dissolve same in 2 pints of boiling water and strain through wire gauze. While still very hot pour slowly into this the pint of kerosene, and then the 2 oz. of tobacco extract, stirring all the time. The latter ingredient (the strong, black sort favoured by seamen and our aboriginals) is quickly prepared by tearing the plug into flakes of leaves and stems which are then boiled for about twenty minutes in the other pint of water; the resultant nearly black fluid being then strained while still quite hot through closely woven linen before adding to the kerosene-soap mixture. During cooling of the finished emulsion it must be stirred vigorously for some minutes and then poured from one vessel to another in such manner as to impart a churning motion until lukewarm.

At this stage it starts to thicken and should then be stirred well until ready to pour into tins or jars, as such final agitation ensures a good, uniform emulsification of the tobacco extract. This stock-emulsion sets after a few hours, attaining a consistency resembling that of frozen butter, and being light chocolate in colour. To prepare a spray for immediate use, melt the amount of stock-emulsion required (according to the number of insects to be treated) over a slow fire, and when quite liquified add six parts of water to one part by fluid measurement of the stock emulsion. Allow this to stand on the stove until reaching a temperature of about 50 deg. C. (just hot enough to be able to hold one's finger in). Apply at once, through a nozzle throwing a misty spray with good force, holding end of same within a few inches of the mealy bugs in order to wet them thoroughly.

Always strain the made-up spray when filling your pump, as this will avoid trouble with atomising nozzles.

When heating either the stock-emulsion or spray be careful to see that it does not boil, or even reach a scalding temperature.

The Spray Does Not Injure Plant Life.

During the testing of this emulsion on different species of mealy bugs attacking cane, cotton, figs, Acalyphas, Ipomea, Beaumontia, &c., the various solutions used were always applied at the same time (while quite hot) to leaves of sweet-potato, tomato, passion fruit, strawberry, papaw, and other foliage; as well as to tender seedlings of cabbage, turnip, beetroot, carrot, &c.

It is satisfactory to be able to record that in no cases did such spraying result in material injury to any plants so treated.

The Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby, has received the following report for the period June to July, 1930, from the Entomologist at Meringa, Mr. E. Jarvis:—

An Erroneous Impression Contradicted.

Among the various remedial measures against cane grubs investigated during recent years there is one which, although proved conclusively to be worthless, still appears to find advocates among certain farmers in our sugar-growing districts.

It is high time that this old delusion concerning the supposed value of white arsenic as a remedy for cane-grubs was fully exposed, seeing that even at the present time there are growers in the Burdekin and elsewhere who continue to be foolish enough to waste their time by using a method which can only result in disappointment and financial loss.

I wish, therefore, to emphasise the fact that although white arsenic might prove serviceable under field conditions if employed in the form of a poison-bait (see Bulletin No. 4, Div. of Ent. Bur. S. Expt. Stns., 1916), it is quite useless to expect to get beneficial results by merely sprinkling or otherwise burying it amongst the roots of sugar-cane.

Dr. Illingworth commenced his experiments with this arsenical in the year 1918, carrying them on throughout a period of about three years, most of his experiment plots being situated on the Greenhills Estate. Some of the methods of application tried during this period were:—

(1) White arsenic placed in drills on sprouting plants,

(2) White arsenic placed under the stools of cane,

(3) White arsenic placed with the sets.

Negative Results with White Arsenic Against Cane Grubs.

Data filed at our Experiment Station giving results obtained on field plots established at Greenhills by Dr. Illingworth in 1921 (about a couple of months before he left Queensland) show that on 23rd March, at the time of year when grubs were doing the greatest damage, no difference was apparent between plots treated with 100 lb. and those which had received 200 lb. of white arsenic per acre. The cane on Block H2 was found to be uniformly grub-infested, no difference being observable between that which had been treated with this poison and cane in the untreated check plots.

Results obtained by digging up the cane stools on these test plots were as follows:—A stool dug in the 100 lb. arsenic plot yielded seven grubs, while another examined in the untreated check plot alongside gave two grubs. Again, a stool dug up in the 200 lb. arsenic plot yielded thirteen grubs, while another stool on the check plot alongside revealed eleven grubs. Thus, it so happened that a final examination of these experiment plots revealed, curiously enough, the presence of more grubs under the stools which had been treated with white arsenic than chanced to occur on the plot which had been left untreated alongside. No dead grubs were obtained from beneath any of the treated or check stools on this H2 block.

The result of this investigation made at Greenhills on 23rd March showed conclusively that as many grubs occurred under cane on land which had been poisoned at the rate of 100 to 200 lb. of white arsenic per acre, as under cane which had not been treated.

Biological Control Work.

At the present time the life history of one of our rare species of digger wasps named *Scolia formosa* Guer. is being studied. This species was first recorded by the present writer in 1923, who succeeded in breeding a specimen captured at Gordonvale, from which twenty-four eggs were obtained. These were all deposited on grubs of our greyback cane beetle, and ultimately yielded eleven cocoons; the wasp, however, refusing to oviposit on grubs of the small brown cockchafer *Lepidiota frenchi* Blkb.

Scolia formosa is about the size of our common digger wasp *Campsomeris tasmaniensis* Sauss., its black abdomen being ornamented with broad bands of rich orange-red; while the head, thorax, and legs are densely clothed with reddish hairs. The present specimen, which was also captured in a flower garden at Gordonvale, has already laid, to date, thirty-one eggs on grubs of the greyback cockchafer. Data of an interesting nature relative to the effect of changes of temperature on the duration of its various life-cycle stages is being recorded from day to day.

The wasps derived from eggs of this insect, being now obtained here, will be welcome additions to our office collection; especially the male specimens, only one of which was secured from my 1920 breeding of this digger wasp.

Visit to the Lower Burdekin District.

During May and June the Assistant Entomologist, Mr. J. H. Buzacott, paid a visit to Ayr, our principal object being to carry out further investigation regarding the habits, metamorphosis, and various methods of controlling the ravages of the "Giant Termite" (*Mastotermes darwiniensis* Frogg.

In the opinion of Mr. Buzacott, the damage caused by this termite is gradually spreading, although "there does not," he remarks, "appear to be any increase in concentration of the pest. The spread is quite local, and cane is being attacked only on farms which are adjacent to those formerly suffering damage." "Grubs," he reports, "have caused damage on several farms near Ayr and considerable damage at Giru, especially along the banks of the Haughton River. The Burdekin Pest Destruction Board paid out nearly £2,000 for greyback beetles collecting from the feeding trees during the flighting season this year.

"The only other pest causing appreciable damage in the district is the bud moth, *Opogona glycyphaga* Meyr., which is badly damaging the eyes of certain canes. Although this moth is usually quite common it rarely reaches the status of a serious pest, but it was certainly killing sufficient eyes to cause a poor strike, and should warrant investigation."

INSECT FRIENDS OF THE CANEGROWER.

ENTOMOLOGIST'S ADVICE FOR AUGUST.

By EDMUND JARVIS.

While ploughing cane land one constantly unearths and exposes to view various forms of insect life, mostly representive of the commoner species of scarabæidæ, familiarly known as cane beetles.

Although growers are, of course, perfectly aware that these abovementioned grubs should be destroyed as far as possible, they understand very little about the habits of other soil-frequenting insects often occurring in the furrow, some of which, being parasites of cane grubs should always be carefully protected.

Chief of these is a sleek-looking, plump, shining white maggot about an inch in length, which is generally found attached to a dead or dying cane grub. This maggot if left in the soil ultimately spins a cocoon of closely woven silk of a reddish-brown colour and the stiffness of brown paper.

About a couple of months later a handsome wasp parasite emerges from this cocoon and digs its way to the surface.

Each of these wasps is able to destroy over a hundred grubs, and breeds at the rate of at least four generations a year.

Other friendly insects include the predaceous larva of a skip-jack or elaterid beetle; and the larva or maggot of a common species of "robber-fly," both of which live in the ground and tunnel about in search of various cane grubs.

The former resembles a large flattened wire worm, about 2 to 4 inches long, while the maggot of the robber-fly has a sharply-pointed beak and exceeds an inch in length.

Hints to Field Assistants.

The activities of the Supervisor in our cane fields may be said to embrace a rather wide range of work, calling, as it does, for a practical knowledge of agriculture, combined with an aptitude for experimental research of a scientific nature; together with a dash of originality and plenty of common sense.

Being on the spot, as it were, he can generally get leave from growers to conduct various experiments on their farms, and is always at hand to supervise the carrying out of same. He is also in a good position to suggest any improvements that may chance to occur to him regarding routine methods of farm cultivation which might facilitate the operation of, or render more effective certain lines of control work against cane grubs or other insect pests.

Another important service which could be performed by the Field Supervisor would be the recording of data in connection with cane varieties, insects, pathological diseases, fertilisers, &c., which come under his notice from day to day.

Such details are always of interest, and should be of future assistance to those concerned, or engaged in studying the control of insects and fungus diseases.

In the work of field experiments or plots designed to test the efficiency or otherwise of insecticides or soil-fumigants, the Supervisor has the best possible chance of securing that harmonious co-operation with the farmer concerned, which certainly goes far towards ensuring the carrying through of such experiments in the best manner.

BUREAU OF SUGAR EXPERIMENT STATIONS.

In recent years the Bureau of Sugar Experiment Stations has made considerable advances in the direction of affording more help to growers and millers. With the return of the travelling scholars, Messrs. Kerr, Bell, and Bennett, it was possible to reorganise the work of the Bureau, which is now divided into four sections, viz.:—

1. *Soils and Agriculture.*—This comprises Sugar Experiment Stations in the Southern, Central, and Northern sugar districts, and an extension service employing field officers located throughout the cane areas, who keep in close touch with cane growers. Numerous experiment trials with cane are established in all sugar localities.

2. *Sugar-cane Pathology.*—Officers employed in the field and laboratory are studying cane diseases and their control.

3. *Entomology.*—Entomologists are maintained at selected locations so as to deal effectively with the study and control of the most important cane pests.

4. *Sugar Mill Technology.*—The Technologist and his staff investigates mill problems and the various phases of sugar extraction and manufacture.

The organisation of the Bureau covers the several branches of growth and manufacture in a manner unique amongst the primary industries of Australia. The funds for its maintenance are contributed equally by the industry and the Government.

The Laboratories of the Divisions of Soils, Agriculture, and Pathology are situated at Brisbane and have just been completed. They are thoroughly up to date and include all the latest apparatus for scientific work. Sugar growers and millers visiting Brisbane are especially invited to call and see the work being carried out in these laboratories, which are situated in the Department of Agriculture's building, in William street. Here investigations and research work in chemistry and physics of our sugar-cane soils, and into the diseases of cane, are being conducted.

New laboratories have also been fitted up at the Mackay Sugar Experiment Station for the work of sugar mill technology. It is hoped to give the mills a considerable amount of scientific assistance in the future, and to help to solve some of their many problems.

The work of the recently formed Queensland Society of Sugar-cane Technologists, it is anticipated, will also have a great effect in improving the sugar industry, and bring it more in line with the world's best practices.

So far from having to increase the levy on sugar mills and growers for the carrying out of this new work and the enlargement of the staff, the Bureau has been able this year by careful management to reduce same from 1d. to ½d. per ton of cane.

THE BROWN CUTWORM (*Euxoa radians* Guen.).

By G. A. CURRIE, B.Sc.

PART II.

TEMPERATURE REACTIONS.

THE cutworm under study is given to sudden and sporadic outbreaks of great severity, and whatever the direct causes of such outbreaks may be, it is the weather which is the ultimate cause of the variation in incidence.

A complete analysis of the factors operating in this connection would be well-nigh impossible, but within certain limits the habits of the cutworm itself reduce that number. As an example of this, it is found that the action of direct wind currents is mostly eliminated by the burrowing habit of the larvæ. Living and feeding amongst an abundance of succulent food counteract the effect of low-atmospheric humidity to a great extent.[2] Resting during the day under cover of food plants and buried in the ground reduces the effect of direct sunlight and allows the larva to burrow towards moisture if it requires to do so. The pupa in its earthen cell is also sheltered from many vicissitudes.

The temperature of its surroundings controls the growth rate of the larva to a great extent, and indeed this can be said of all stages of the life history. If the growth rate in relation to temperature is known, it is possible to predict with considerable accuracy, the time at which different stages will be reached and when recurrence of attacks may be expected.

A knowledge of the temperature relations of *Dysdercus sidæ*[3] gained while assisting in some work on that insect enabled one to go into the field with an accurate knowledge of the stage in which the insects would be found. A study of the temperature relations of all stages of *Euxoa radians* was undertaken with a view to getting a working knowledge of the length of each life stage at different temperatures.

A short résumé of some of the work done on the temperature relations of insects might not be out of place here.

Resume of Some Previous Work.

Abbé (1878) published his work on the thermal constant of locust eggs.

Sanderson (1908) defined the thermal constant as "The accumulation of mean daily temperature, above a critical point for the species, causing it to issue from hibernation or change instars." This is the "temperature summing" which was used by American entomologists in predicting the emergence from hibernation of the boll weevil.

Weissman (1882), working on the seasonal dimorphism of a butterfly, was able to show that if the summer form were cooled down slowly and then warmed up again, it could be made to emerge in October in the winter form. If, however, it were kept at a warm temperature without being cooled down, it would pass the winter before emerging. The cooling down was necessary for the normal development of the winter form. It will thus be seen that the life stage of this insect had a direct effect, apart altogether from its normal reaction to temperature.

Merriam (1894) published the "Laws of Temperature Control of the Geographical Distribution of Temperate Plants and Animals." In that work it is stated that "Animals and plants are restricted in northward distribution by the total quantity of heat, that is to say, the sum total of mean daily temperature above 43 deg. Fahr. during the season of growth and reproduction." The temperature 43 deg. Fahr. was regarded as the temperature below which no perceptible growth occurred. This is the temperature summing principle already mentioned.

Howard (1895) published his work on the temperature relations of household insects, and later showed that the distribution of the yellow fever mosquito (*Aëdes aegypti* L.) was controlled by temperature. A knowledge of its temperature requirements would enable one to predict its behaviour and spread, in districts where it might be accidentally introduced.

Chittenden (1899) showed how low winter temperatures might be effective in preventing the spread of insects to new areas.

Bachmetjew (1901-1902), working on the relation of temperature to insect activity, found that for every insect a definite range of temperatures exists, between the extremes of which the insect is active. At a temperature known as the "optimum," activity is at its greatest. A raising or lowering of the temperature away from the "optimum" lowers the rate or metabolism. At a certain high temperature above the "optimum" activity ceases and metabolism is almost at a standstill, death ensuing in time if the high temperature is maintained. A still higher temperature exists (at which death is instantaneous), and this can be called the "upper thermal death point." A low temperature exists at which activity ceases, metabolism is extremely slow, and a state which can be called "hibernation quiescence" ensues. At a low temperature, the "critical point," the internal heat of the insect suddenly rises, but if cooling is continued the temperature again falls to the "critical point" and death follows.

Sanderson (1905, 1908, 1910) shows how species are restricted to life zones by temperature. He shows the relation existing between temperature and hibernation, and in "The relation of temperature to insect growth" suggests that by keeping a series of insects at constant temperatures a graph can be built up, showing the relation of each insect to the whole range of temperatures to which it may be submitted.

Instead of the "temperature summing" above the developmental zero, he suggests that the percentage of time required to complete each stage at the different temperatures be used as units.

Cotton (1908) used his knowledge of the temperatures required to hatch the eggs of the Southern Cattle Tick to mark out areas which would be safe from infection at different periods of the year.

The "Bioclimatic Law" of Hopkins gives a practical application of the response of insects to temperature.

The combined effect of humidity and temperature has been investigated by various writers, and a great variation in the tolerance to wide ranges of humidity is found in different species. Headlee (1914) investigated the effect of temperature and humidity on the rate of insect development, and Pierce (1916) published a graphical figure showing the effect of a range of temperatures and humidities on the life functions of the boll weevil. Shelford (1926) produced a graphical representation of the effect of combined temperatures and relative humidities in common animals of temperate latitudes.

In this connection it is well to reiterate that Headlee (1914)[2] found that "The rate of metabolism in certain actively feeding insects with abundance of succulent food available is not affected by large differences in atmospheric humidity." These conditions obtain in the Queensland experiments with *Euxoa radians* larvæ, and appear to give a like result, within certain limits.

In some cases it has been found that the temperature reactions of insects vary with the different seasonal generations of the insects under study.

A recent development of temperature work has been published by W. C. Cook.[4] He submitted numbers of cutworms of the species *Porosagrotis orthogonia* and *Chorizagrotis auxiliaris* to varying numbers of hours at high temperatures, alternating with the remainder of the day at a constant low temperature of 8 deg. C. He found that the growth rate per hour at the high temperature when alternating with the low, was greater than the growth rate per hour at a constant high temperature. For the species examined eight hours at the high temperature of 32 deg. C. alternating with sixteen hours at 8 deg. C. gave the greatest growth rate per hour.

From his data in those experiments, Cook (loc. cit.) constructed a solid model with time and temperature as his horizontal axes and growth rate as his vertical axis. The rate of metabolism or growth may be predicted on this model for any time-temperature combination.

Shelford[5] states that development under fluctuating temperatures is 1·02 to 1·08 times as fast as under constant temperatures.

In the constant temperature experiments, to be described later, this matter of fluctuating temperatures in the field must be borne in mind. In practice the half-daily observations used in these experiments over the length of time taken to pass through each instar, would introduce a possible experimental error as great, or in some cases greater than the error due to constant temperature. Field and laboratory controls have been kept, and the results of these are incorporated in the graphs, to show the variation between the time of development at constant, as contrasted with fluctuating temperatures.

Co-ordination of Field and Laboratory Work.

At the Cotton Research Farm, Biloela, a complete set of meteorological records is kept. For entomological use a continually recording thermometer gives the temperatures at a depth of about 1 inch in the ground and under cover of such vegetation as the caterpillars may be using from time to time. This gives a good idea of the temperatures to which the caterpillars or pupæ in the soil are being subjected at any time of the year.

It is found that under cover at a depth of 1 inch to 2 inches in the soil, the daily rise and fall of temperature moves about a mean which is very nearly the true mean of the daily maximum and minimum temperatures.

At such a depth under good cover the daily mean is not far different from the mean daily shade temperature of the air, although not so subject to sudden rises or falls. After the ground has warmed up in summer, however, this soil mean is consistently higher than the shade mean during dry weather. During a dry spring cutworms are frequently found in situations where vegetation is sparse.

Well cultivated fields with cotton seedlings newly through the ground provide such situations. In such cases the heat of the sun during the day raises the surface soil temperatures up to high figures and, where shade is absent, eggs may be destroyed by the heat, while it is also possible that a day of extremely high temperature may destroy pupæ in exposed situations where cover has been removed. On such a day, soil temperature in a place where there was no cover has risen in October, at 2 inches depth to a value of 129·5 deg. Fahr.

In the case of the caterpillars, however, although exposed at times, and for short periods to temperatures of over 100 deg. Fahr., they can always seek cover, and no case has been observed where they have been killed by the direct action of the sun's heat.

These data from the field, coupled with the results of laboratory temperature experiments, help in gaining a good idea of the rate of development, or stage of life history, and activity of the various insects under observation. In the case of *Euxoa radians* field and laboratory experiments were carried out bearing on its rate of growth at different temperatures, and the laboratory technique will now be dealt with.

LABORATORY TECHNIQUE.

In these experiments groups of eggs, larvæ and pupæ were subjected to a range of constant temperatures to determine the duration of each life stage at different temperatures.

A multiple temperature incubator (Model 3) made to the specification of C. B. Williams and T. W. Kirkpatrick,[6] Egypt, was used.

The heat in this case was supplied by an electric bulb with carbon filaments. Each lid covered a compartment in which there was placed a maximum and minimum recording thermometer. Although the temperature in each compartment kept fairly constant, yet the outside temperature and the amount of ice in the ice box, together with possible variations in the electric current, caused some variation which was recorded half-daily on the thermometer. A range of fairly constant temperatures from about 46 deg. Fahr. at the cold end to about 120 deg. Fahr. at the hot end of the incubator was obtained.

A few typical records from different parts of the incubator are given in Table IV. and will serve to show the range of temperatures from which the means were derived.

Pupa.

The pupal instar was first dealt with and for this purpose large numbers of larvæ were collected in the field. They were placed in jars with half an inch of sifted soil into which they could burrow. The jars were open at the top to allow free passage of air. Pigweed (*Portulaca oleraceæ*) was supplied to the larvæ for food, this plant being used throughout the experiments as the standard food for all stages of the larvæ. The larvæ were examined twice daily so that they could be transferred at once to the incubator when they pupated. The size and sex of the pupæ were noted in all cases.

In order to keep soil humidity nearly equal throughout the series of temperatures, the soil in which the pupæ lay was kept moist. Moistening had to be done frequently in the warm compartments and seldom in the cold ones. Each pupa was placed in a 2-ounce glass jar on sifted soil, the jar having a number etched into it, the lid not being used so that air circulated freely.

When emergence of the adult moth was seen to be imminent, by the darkening of the pupa, a plug of cotton wool was placed in the mouth of the jar to prevent escape of the moth. A piece of stiff cardboard was leant across the jar from top to bottom so that the emerging moth could cling to its under surface to unfold its wings.

Egg.

These were placed in glass jars in groups of twenty. In the hot compartments some moistening was done to prevent desiccation. Hatching was watched for, and the larvæ supplied with food and covered over to prevent escape.

Larval Instars.

While small, the larvæ were put into jars in batches of ten, and fed on pigweed. A very little soil was given at first, the quantity increasing with size. New food was given daily and the soil frequently changed to keep conditions hygienic. Uniformity of humidity was not possible in the different compartments, but the soil in each was kept slightly moist to maintain uniformity as far as possible.

Owing to the high mortality of cutworm larvæ large numbers were necessary in each series. Much difficulty was experienced in finding the head capsules from the moults, so individual larvæ were isolated for the purpose. The larvæ seemed to do better in groups until they were nearly full grown, when they did well separately. In order to get a reliable indication of the average time taken to complete a stage, three methods were used:—(1) Single larvæ were isolated and their moults observed and noted; (2) Groups of larvæ were kept together and the first individual to moult to the following instar noted, and the last, for each succeeding stage; (3) Groups of larvæ individually noted were averaged as to their moulting times.

A certain amount of compensation was noticed in healthy broods, for, when certain individuals took abnormally long to go through one or two instars, they tended to shorten the later ones. In this way the variation in pupation dates was relatively less than the variation in the dates of passing from the earlier to later larval instars.

The larvæ were found to thrive best when sifted soil and plant debris were present for them to shelter in and this added to the difficulty of observation.

In the groups of larvæ the moults were observed by the light colour of the head capsule and skin of the newly moulted larvæ, the individuals not newly moulted being much darker in colour.

In the incubator the larvæ were kept in darkness so that there was a possibility that this might affect the rate of development. To check this a group of newly hatched larvæ was divided in two. One lot of larvæ was kept in the laboratory in a jar freely exposed to the light, while the other lot was placed in a similar jar but wrapped round with brown paper to exclude light completely. A slightly faster rate of growth was observed on the part of the cutworms reared in the dark, but the difference noted was not great. Table III.

Experiments were also carried out with series of larvæ as near field conditions as possible, so that their rate of development could be compared with that of the larvæ in the incubator, subjected to a constant temperature.

Adult.

On emergence from pupation the moths were placed in pairs (male and female) in large glass jars with cheese-cloth covers.

In the field eggs were laid in the loose soil under low-spreading vegetation. In jars without soil, moths laid under compulsion, but laid more freely when loose soil was sprinkled over the bottom, and plants of pigweed laid on top of it. The eggs were found laid on the glass bottom of the jar, so firmly cemented on that they could not be removed without bursting.

It was necessary to get the eggs on some movable medium to be used in the incubator, so the following expedient was adopted. A false bottom of brown paper was placed in the jar and soil sprinkled over it. The eggs were found each morning firmly cemented to the brown paper, which could be lifted out, the eggs counted, and the paper cut up into pieces having any desired number of eggs adhering.

The moths were fed on sugar solution, honey solution, or fresh flowers were given them to feed from. Each pair was removed to a freshly prepared jar daily, and the old one searched for eggs. Besides being laid through the loose soil on the brown paper, eggs were often found on the pigweed leaves. In one case where water had been spilt over the bottom of the par, soaking the soil, the female laid her eggs on the cheese-cloth cover of the jar.

RESULTS OF TEMPERATURE WORK.

In setting out the results of the temperature work the graphical method of representing the data has been used wherever possible. Where graphs are not suitable the results are tabulated.

In the following table is found the results of the experiment to compare the rate of development in cutworms exposed to normal daylight, with those kept in darkness, all other conditions being as nearly as possible equal.

Fifty first instar larvæ were used in Series 1, thirty in Series 2, but only those which reached pupation are recorded in the Table.

TABLE III.—Egg Hatching to Pupation in Light and in Darkness.

Series 1.

—	Darkness.	Light.	Average Temperature.
1	47 days	40 days	23·8 deg. C.
2	37 days	41 days	23·8 deg. C.
3	40 days	46 days	23·8 deg. C.
4	41 days	39 days	23·8 deg. C.
Averages ..	41·25 days	41·5 days	..

Series 2.

—	Darkness.	Light.	Average Temperature.
1	32 days	34 days	25·5 deg. C.
2	33 days	33 days	25·5 deg. C.
Averages ..	32·5 days	33·5 days	..

The numbers surviving are too small to do more than indicate a probability, but the larger numbers of ordinary laboratory and field observations can be compared with the incubator numbers for further confirmation.

The results of the work with the pupæ will be reviewed first, as this instar was more intensively observed than the others, owing to its interest in the field as the stage which survives severe winter weather.

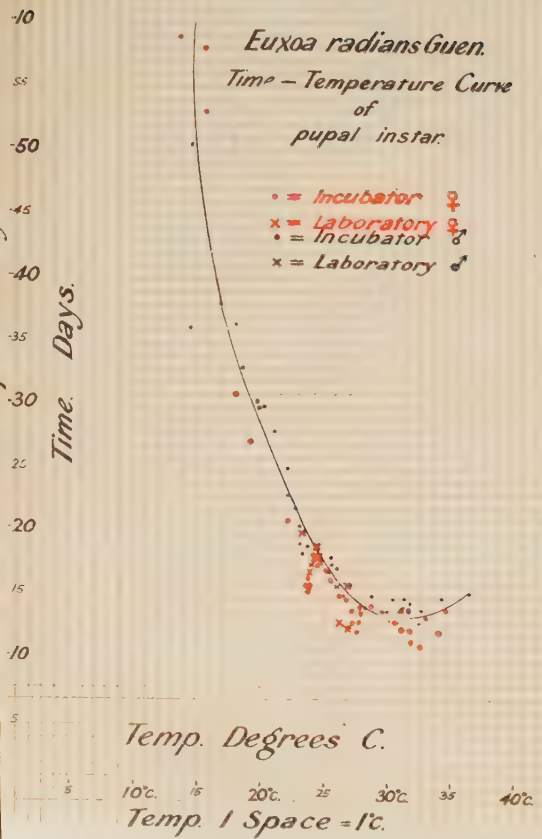
A few typical temperature records taken from the hot end, the middle, and the cool end of the incubator will show the daily range of temperatures obtaining within the compartments of the incubator used. The fact that there is a fluctuation in temperature makes it impossible to call the work strictly constant temperature work, but the range is too small to cause any marked change of growth rate due to such fluctuation.

TABLE IV.

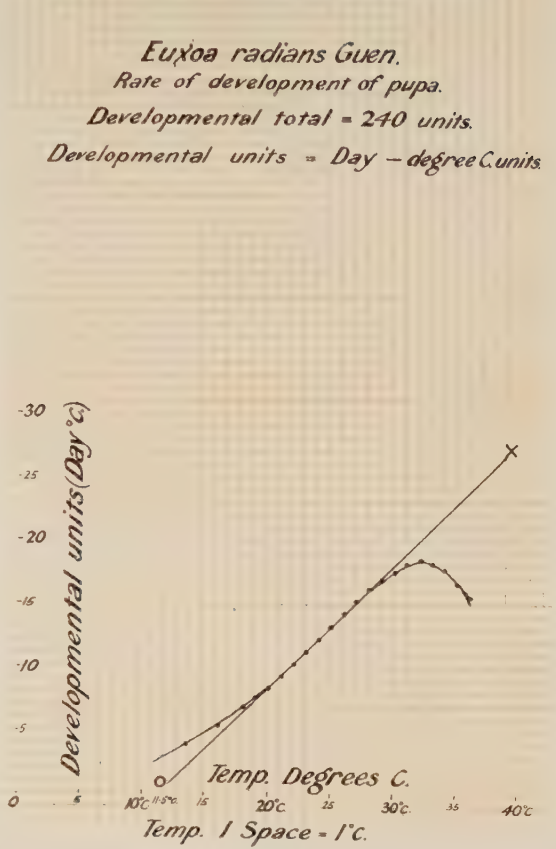
Typical Temperature Records on Life Sheets of Pupæ in Incubator.

Compartment (3). Length 19·5 mm. ♀ pupa. Pupated 12 noon, 29 Dec., 1927			Compartment (12). Length 20 mm. ♀ pupa. Pupated 7-8 Dec., 1927.			Compartment (19). Length 19 mm. ♂ pupa. Pupated 4-5 Dec., 1927.		
Date.	Max.°F.	Min.° F.	Date.	Max.°F.	Min.° F.	Date.	Max.°F.	Min.° F.
1927.			1927.			1927.		
29 Dec. ..	94	90	8 Dec. ..	78	76	5 Dec. ..	76	68
30 Dec. ..	97	91	9 Dec. ..	77	74	6 Dec. ..	73	68
31 Dec. ..	98	91	10 Dec. ..	78	74	7 Dec. ..	71	65
1928.			11 Dec. ..	79	76	8 Dec. ..	68	65
1 Jan. ..	99	94	12 Dec. ..	77	75	9 Dec. ..	68	65
2 Jan. ..	98	90	13 Dec. ..	77	74	10 Dec. ..	68	64
3 Jan. ..	92	88	14 Dec. ..	77	74	11 Dec. ..	70	66
4 Jan. ..	94	90	15 Dec. ..	78	75	12 Dec. ..	68	65
5 Jan. ..	93	90	16 Dec. ..	80	78	13 Dec. ..	67	65
6 Jan. ..	99	90	17 Dec. ..	78	75	14 Dec. ..	69	65
7 Jan. ..	98	92	18 Dec. ..	77	75	15 Dec. ..	70	66
8 Jan. ..	97	90	19 Dec. ..	78	76	16 Dec. ..	69	64
9 Jan. ..	91	89	20 Dec. ..	79	75	17 Dec. ..	68	65
10 Jan. ..	90	87	21 Dec. ..	77	73	18 Dec. ..	68	66
11 Jan. ..	92	89	22 Dec. ..	77	75	19 Dec. ..	69	66
12 Jan. ..	91	89	23 Dec. ..	78	77	20 Dec. ..	70	66
			24 Dec. ..	75	72	21 Dec. ..	68	65
			25 Dec. ..	72	70	22 Dec. ..	68	64
			26 Dec. ..	78	72	23 Dec. ..	69	65
						24 Dec. ..	65	61
						25 Dec. ..	63	60
						26 Dec. ..	70	63
						27 Dec. ..	71	67
						28 Dec. ..	71	67
						29 Dec. ..	70	66
						30 Dec. ..	71	65
						31 Dec. ..	70	67
						1928.		
						1 Jan. ..	71	69
						2 Jan. ..	71	68
Emerged adult 12-13 Jan., 1928. Average, Temp. 92·5 deg. Fahr. Time, 14½ days.			Emerged adult, 26-27 Dec., 1927. Average Temp. 76 deg. Fahr. Time, 18-19 days.			Emerged adult 3 Jan., 1928. Average Temp. 67·3 deg. Fahr. Time, 29 days.		

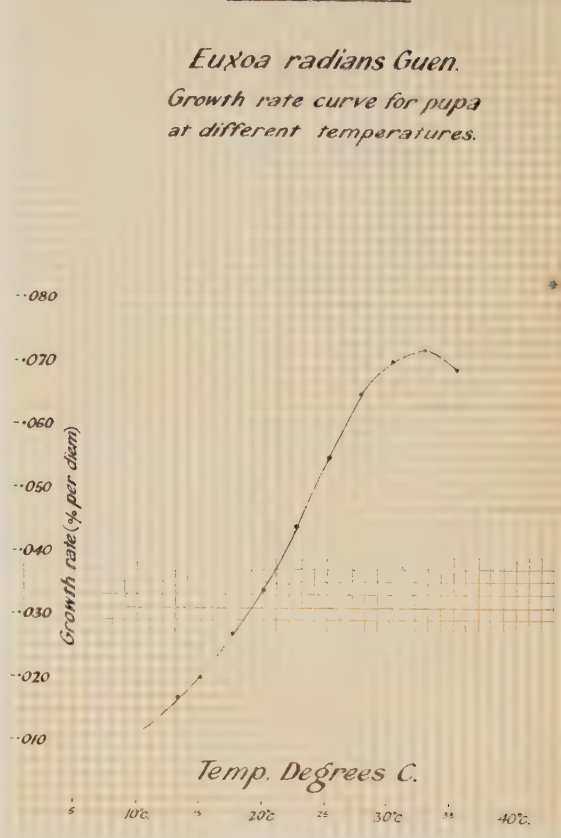
— GRAPH 1. —



— GRAPH 2. —



— GRAPH 3. —



Graphs showing rate of development of eggs and larvæ of *Euxoa radians* Guen. in relation to temperature.

Graph 1 shows the time-temperature curve for the pupal instar. The points marked represent individual pupæ. The curve sketched in is arbitrary, arrived at by averaging times in temperature class groups, and is only included to indicate the general direction of the theoretical curve.*

Graph 2 shows the same set of data used to give the growth rate, or better "development rate," in developmental units. The method is as follows[5]:— The developmental zero, or temperature below which no visible development occurs can be determined for the species from the time-temperature graphs.

For example, this can readily be done by taking two points on the time-temperature curve between 20 deg. C. and 28 deg. C. Time and temperature are multiplied together at the two points, the results subtracted, and the remainder divided by the difference in the number of days between the two points, e.g.:—

Temperature 20 deg. C. × days 28·5 = 570
Temperature 21 deg. C. × days 25·5 = 535
Difference 35
Difference between points in days, 3.
Developmental zero = 11·66 deg. C.

By averaging a number of such results the approximate developmental zero for *Euxoa radians* was found to be 11·5 deg. C. This developmental zero is a theoretical and not a true biological point, as can be seen from the graph.

The developmental zero being established, the temperature summing curve can be proceeded with. The developmental total in day-deg. C. units is got by multiplying the number of days taken to complete a stage at any temperature, by that temperature in deg. C. less 11·5 deg., e.g..—

At 27 deg. C. No. of days = 15·5.
Developmental total = 15·5 × (27 deg. − 11·5)
= 15·5 × 15·5
= 240 day deg. C. units.

The average developmental total in the range 20 deg. C. to 28 deg. C. was found to be near 240 day deg. C. units. By dividing this figure by the number of days taken to complete each stage at any given temperature, a number is obtained which represents the number of developmental units gone through each day at that temperature, e.g.:—

At 20 deg. C. 8·5 units of the total 240 are gone through in one day.

From a series of such points the Graph B. has been built up, and from it can be read off, at any temperature, the daily growth of the pupa in developmental units.

It will be seen that in B. the curve between 20 deg. C. and 28 deg. C. is a straight line, which means that between those limits growth rate and temperature increases proportionately. This straight part of the curve produced to OX is at an angle of 45 deg. to the horizontal so that the reading along both axes is the same for the straight part of the curve, if the point O. or developmental zero, is read as true zero on the horizontal axis.

Above 28 deg. C. and below 20 deg. C. this relation does not hold true. In the former case increase of temperature above 28 deg. C. leads

* In order to arrive at the true position and shape of the curve for the points obtained experimentally, the *curve fitting* may be done by the "Method of Least Squares" as explained by R. Pearl in his "Introduction to Medical Biometry and Statistics," 1927, Chapter XVI., pp. 332-341.

at first to a decrease in the acceleration of the growth rate, and above 32 deg. C. to a retardation in relative growth rate.

Below 20 deg. C. falling temperature tends to cause development to decrease at a lower rate, so that the curve tends to become asymptotic to the temperature axis.

There must be a point in the low temperature range at which development and activity cease, either from the freezing of the "free water"* in the organism or from the cessation of feeding, assimilation, or some other life function.

This point was not determined experimentally in the present experiments, but from the general shape of the curve it would appear to be between 3 deg. C. and 5 deg. C. This being so, the curve cannot become a true asymptote to the temperature axis.

In Graph 3 the data from A. are represented in a growth rate curve. The growth rate is the percentage of total development passed through in any period of time (in this case a day) at any given temperature. It is the reciprocal of the time taken to pass through any one stage of life history of the species; in this case the pupal, e.g.:—

At a temperature of 15 deg. C. it takes 50 days to complete the pupal instar. The reciprocal of time is one-fiftieth and this is represented on the vertical axis as ·02.

The slow growth rate at low temperatures allows the pupa to remain in the ground in the cold winter for a long period, and so pass over in a quiescent state the period when food is not available.

The egg curve in Graph 4 is made up from observations of the hatching time of batches of twenty eggs at different temperatures. Each point on the curve therefore represents twenty individuals. The regularity of distribution of these points is obviously due to the absence of many vicissitudes which assail the other life stages.

The time temperature curves for the six larval instars are shown in Graphs 5, 6, 7, 8, 9, 10, respectively. Each point on 5 represents ten larvæ, on 6 five larvæ, on 7 two larvæ, on 8 two larvæ, and in 9 and 10 one larva.

The curve Graph 11 represents the total larval developmental period —egg hatching to pupation. It was arrived at by summing the data of all the larval instar curves and adding the prepupal stasis. The relative value of this curve can be seen by comparing it with the true points got in the incubator, laboratory, and field for the total larval periods; these points being shown separately on the graph.

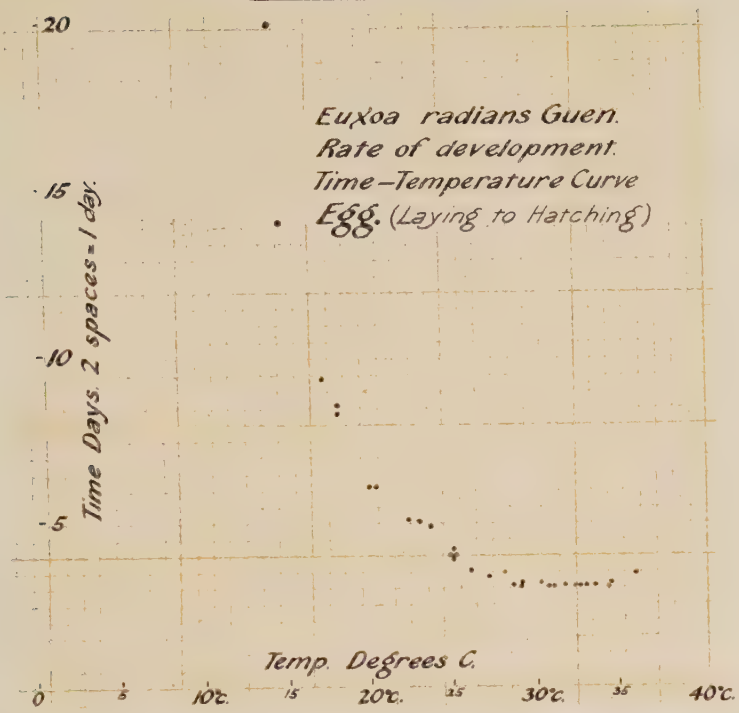
Time and temperature, or rather growth rate and temperature, can be treated as two variants and their frequency distribution plotted.

The product-moment method of determining the correlation between two variants is not adapted to curvilinear progression, so that the ordinary time-temperature points cannot be used in this connection. That part of the growth rate curve between 20 deg. C. and 28 deg. C. which has already been seen to be straight can be employed however, the reciprocals of time being used, instead of time in days.

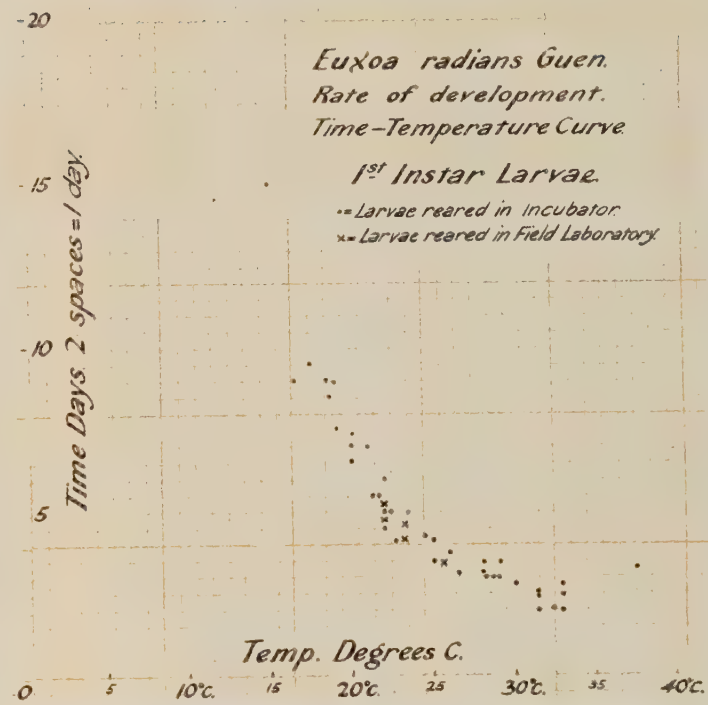
Examination of the data in the light of this mathematical method gives a true measure of the accuracy of the figures relative to complete correlation.

* This "free water" as contrasted with "bound water" is dealt with by W. Robinson in the "Journal of Economic Entomology," vol. 20, No. 1, p. 80. "Water Binding Capacity of Colloids a Definite Factor in Winter Hardiness of Insects."

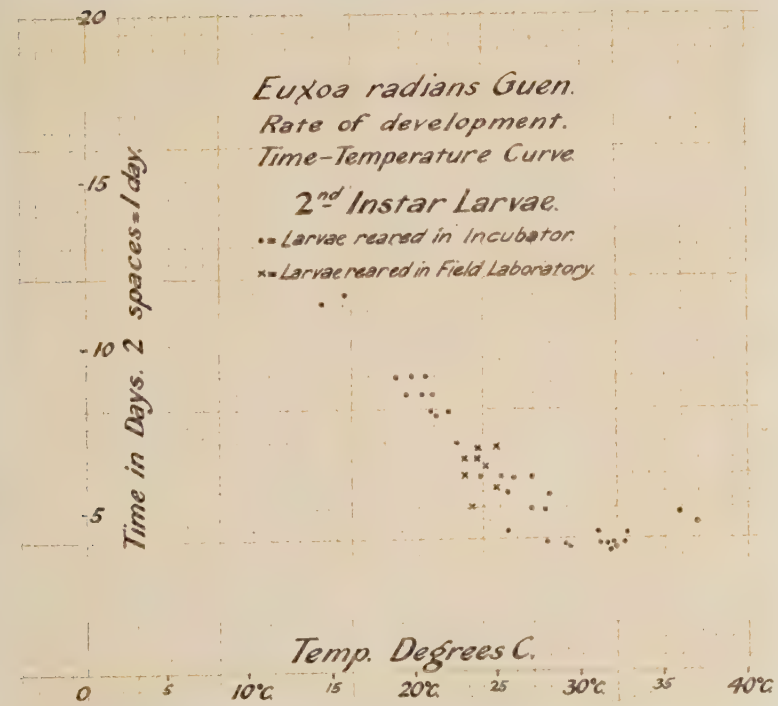
— GRAPH 4. —



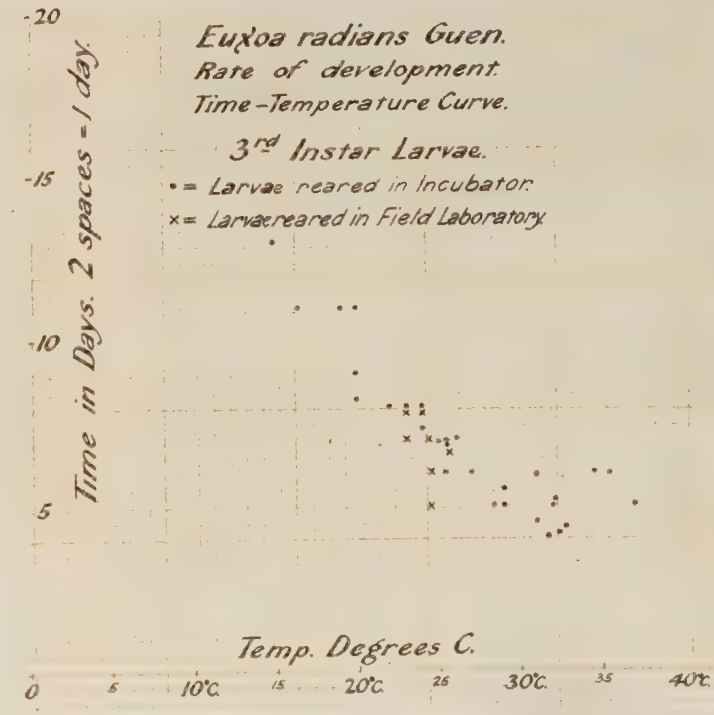
— GRAPH 5. —



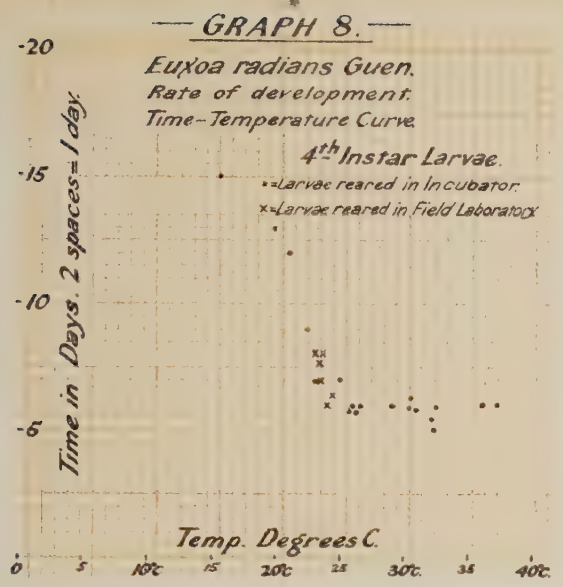
— GRAPH 6. —

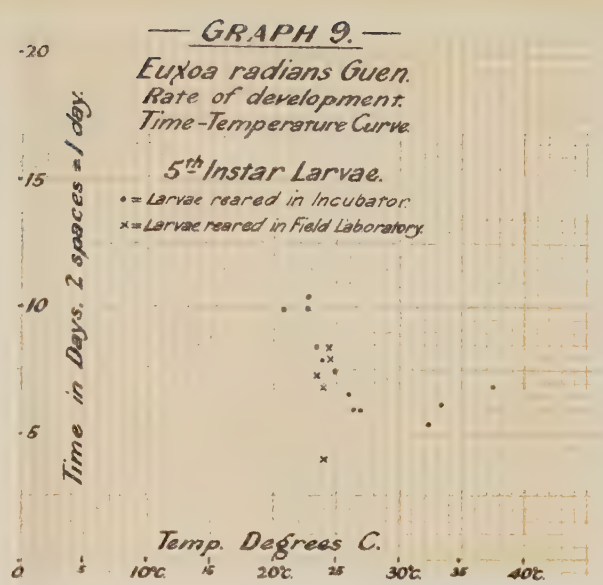


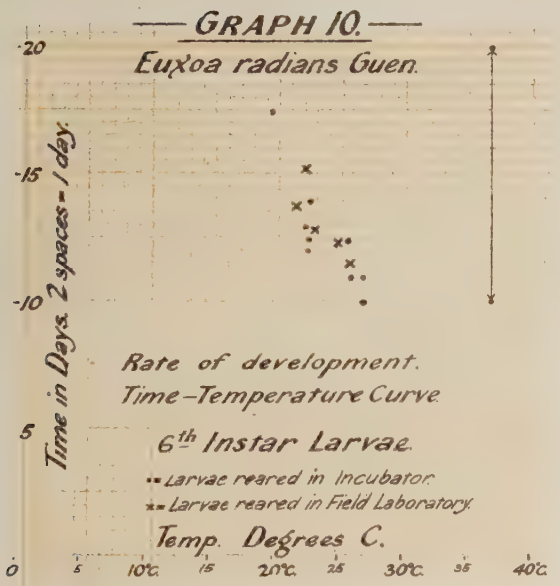
— GRAPH 7. —

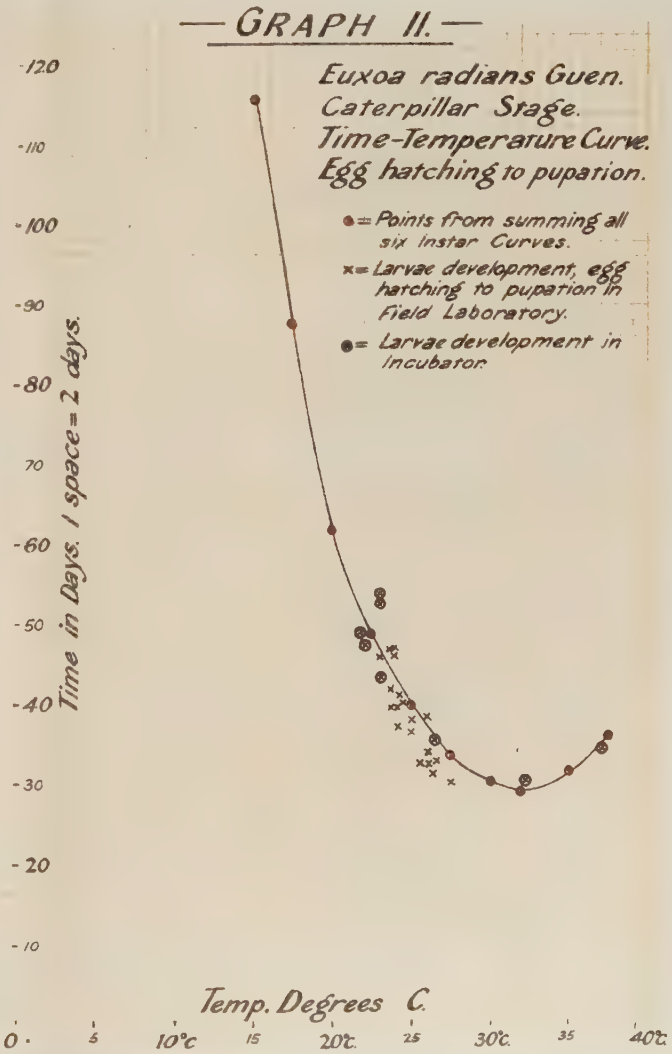


Graphs showing rate of development of eggs and larvæ of *Euxoa radians* Guen. in relation to temperature.









Graphs showing rate of development of larvæ of *Euxoa radians* Guen. in relation to temperature.

The example given below shows the method used by the plant-breeders Hayes and Garber[7] applied to the data found for the egg of *Euxoa radians*.

Euxo radians Guen. EGG DEVELOPMENTS—LAYING TO HATCHING.

CORRELATION OF DEVELOPMENT RATE AND TEMPERATURE BETWEEN THE TEMPERATURES 19·5° C. AND 28·5° C.

TEMPERATURE CLASSES EACH 1½° C.

DEVELOPMENT RATE CLASSES. Class = ·03 of time taken to complete stage.	1	2	3	4	5	6	fy	$\Sigma(yX)$	$\Sigma(yX^2)$	$\Sigma(XY)$	$y\overline{X} = \Sigma\frac{yX}{fy}$
(·15 – ·18) 1	2						2	2	2	2	1
(·18 – ·21) 2		1	1				2	5	13	10	2·5
(·21 – ·24) 3			1	1			2	7	25	21	3·5
(·24 – ·27) 4				3			3	12	48	48	4
(·27 – ·30) 5					2		2	10	50	50	5
(·30 – ·33) 6						2	2	12	72	72	6
fx	2	1	2	4	2	2	13	48	210	203	22
$\Sigma(xY)$	2	2	5	15	10	12	46				
$\Sigma(xY^2)$	2	4	13	57	50	72	198				
$\Sigma(XY)$	2	4	15	60	50	72	203				

$\Sigma\left(\frac{xY}{n}\right) = \frac{48}{13} = 3{\cdot}54 = \overline{Y}$

$\Sigma\left(\frac{xY^2}{n}\right) = \frac{198}{13} = 15{\cdot}23$

$\frac{\Sigma XY}{n} = \frac{203}{13} = 15{\cdot}6$

$$\frac{\Sigma(yX)}{n} = \tfrac{48}{13} = 3{\cdot}7 = \overline{X},$$

$$\frac{\Sigma(yX^2)}{n} = \tfrac{210}{13} = 16{\cdot}15,$$

$$\frac{\Sigma(XY)}{n} = \tfrac{203}{13} = 15{\cdot}6.$$

$$r\,x\,y = \frac{\frac{\Sigma(XY)}{n} - \overline{X}\,\overline{Y}}{\sqrt{\frac{\Sigma(yX^2)}{n} - X^2}\ \sqrt{\frac{\Sigma(xY^2)}{n} - Y^2}}$$

$$r\,x\,y = \frac{15{\cdot}6 - 13{\cdot}1}{\sqrt{16{\cdot}5 - 13{\cdot}69}\ \sqrt{15{\cdot}23 - 12{\cdot}53}}$$

$$r\,x\,y = \frac{2{\cdot}5}{1{\cdot}64 \times 1{\cdot}67} = \frac{2{\cdot}5}{2{\cdot}7}$$

$$r\,x\,y = {\cdot}926 \pm {\cdot}025$$

$$\text{P.E.} = \frac{{\cdot}6745\,(1 - r^2)}{\sqrt{n}} = \frac{{\cdot}091}{3{\cdot}6} = {\cdot}025$$

In the ideal case where no other factor enters in to affect growth rate, the correlation between growth rate and temperature would be 1 (i.e., 100 per cent.).

In practice it is found that the best correlation is shown where the same number of observations is taken in each temperature class.

In the example it will be seen that the temperature classes are one and a-half degree classes, while the growth rate classes are each ·03 of the total time taken to pass through that life stage.

One of the factors (and one already mentioned) which tends to reduce the correlation ratio between growth rate and temperature is the factor of compensation. An example of that is seen in Graph 9 where a larva took only four days instead of the normal seven to nine days at 24 deg. C. to complete the fifth instar.

The high degree of correlation and the compact form of the graph for the egg and first instar larvæ are not maintained in the later instars. The degree of correlation which nearly approaches "one" in the egg stage slowly falls down as the age of the larvæ increases, the bigger larvæ being open to relatively more disturbance by external, and probably internal influences.

Humidity as a factor appeared to act as follows:—At all "medial" humidities, that is to say, between 30 per cent. and 80 per cent. relative humidity, the correlation between time and temperature seemed unaffected by humidity. When, however, the relative humidity went over 80 per cent. for any period longer than half a day continuously, there was a retardation in the growth rate and an unhealthy condition of the larvæ. If the high humidity continued and the temperature was high, death generally supervened.

This aspect of the subject will be more fully dealt with in the oecological discussion to follow, and examples of humidities causing disease and death are tabulated. (Table VII.)

The following table gives the average time taken by the various stages *of Euxoa radians* to complete those stages at "medial" humidities and in the case of the larval instars, in the presence of unlimited food:—

TABLE V.

Average Time in Days to complete each Instar.

Average Temperature.	Egg.	1st instar.	2nd instar.	3rd instar.	4th instar.	5th instar.	6th instar.	Egg hatching to pupation.	Pupal instar.	Egg laying to adult moth.
17 deg. C. ..	9	9½	11	11½	13	14	34	94	36	139
20 deg. C. ..	6¼	7	8½	9	10	10½	17	62	28	96
23 deg. C. ..	4¾	5	6¾	7¼	8	8½	12½	48	20	73
26 deg. C. ..	3½	3¼	5	6	6¼	7	11	38	16	58
29 deg. C. ..	3	2¼	4¼	4¾	5¼	6	10	32½	14½	50
32 deg. C. ..	3	2	3¾	4¼	5	5½	9½	30	13	46

It will be seen that the figures for the sixth instar larvæ include the prepupal stasis and the figures for egg laying to adult moth have been brought to the nearest whole number. The temperature 32 deg. C. is the optimum in the sense of most rapid development for the species, but the use of the word "optimum" in that connection must not be confused with the "optimum" conditions for the survival or increase of the species.

The activities of the imagines were found to be affected by temperature in the same way as the development of the larval stages.

The periods before mating and after mating and before oviposition were found to be increased by low and decreased by high temperatures.

Some of the periods found in the laboratory for female moths are shown in the table:—

TABLE VI.

Period between Emergence of Females and Oviposition.

No.	Date Emerged Adult.	Average Temperature.	Date of First Laying.	Days—Emergence to First Lay.
	1927.		1927.	
1 ..	6 Dec. ..	22·5 deg. C.	14 Dec. ..	8
2 ..	9 Dec. ..	22·5 deg. C.	16-17 Dec. ..	7-8
3 ..	21 Dec. ..	24·0 deg. C.	28 Dec. ..	7
			1928.	
4 ..	25-26 Dec. ..	24·5 deg. C.	31 Jan. ..	6
5 ..	26 Dec. ..	24·5 deg. C.	2 Jan. ..	6
6 ..	28 Dec. ..	24·5 deg. C.	3 Jan. ..	6
	1928.			
7 ..	30 Jan. ..	26·0 deg. C.	2-3 Feb. ..	3-4
8 ..	3 Feb. ..	26·0 deg. C.	7 Feb. ..	4
9 ..	5 Feb. ..	26·0 deg. C.	8 Feb. ..	3
10 ..	10 Feb. ..	26·6 deg. C.	13 Feb. ..	3
11 ..	29 Jan. ..	26·6 deg. C.	31 Jan., 1 Feb...	2-3

The response by all stages of the life history of *Euxoa radians* to temperature has now been established. Little development takes place at 15 deg. C. and the most rapid rate is found at 32 deg. C., above which temperature there is a decrease in the rate of development. At a continuous temperature of 37 deg. C. all stages of the species succumb after a longer or shorter interval, but death from instantaneous exposure requires a much higher temperature.

DESCRIPTION OF LIFE CYCLE STAGES.

Adult.

(Description extracted from "Catalogue of the *Lepidoptera phalaenæ*," Vol. IV., Brit. Mus. N.H., 1903.)

Plate I., figs. 3 and 4.

Euxoa radians.

"*Agrotis radians* Guen., Noct. i. p. 261 (1852).
Agrotis munda Wlk., x. 348 (1856).
Mamestra basinotata Wlk., xv. 1686 (1858).
Agrotis turbulenta Wlk., xxxii., 703 (1865).
Agrotis injuncta Wlk., xxxii., 703 (1865).
Agrotis scapularis Feld. Reis. Nov., pl. 110. f. 13 (1874).

"Head and thorax reddish brown mixed with white; tegulæ with dark medial line; abdomen pale ochreous suffused with fuscous, the ventral surface whitish irrorated with brown, the anal tuft rufous; tarsi banded with black. Fore wing brown mixed with white especially towards costa, on which is a series of small black spots; the veins with dark streaks, the median nervure and vein 1 defined on each side by white; a curved sub-basal line from costa to sub-median fold, interrupted in cell; a curved double antemedial line between median nervure and vein 1 filled in by whitish; claviform elongate, dark brown defined by black; orbicular and reniform with fuscous centres, whitish annuli and black outline, the former small, elliptical, the latter well developed and with the cell between the stigmata dark brown; the post-medial line very indistinct, minutely waved, bent outwards below costa, excurved to vein 4, then oblique; the terminal area much browner; the subterminal line prominent and white or very indistinct, dentate, with a series of dentate blackish marks before it and streaks in the interspaces beyond it ending in the terminal series of small black lunules; cilia pale, with two fine brown lines through them. Hind wing semihyaline white, the costal and inner areas tinged with ochreous; the veins brownish, the termen suffused with fuscous, narrowing from costa to a point at vein 2; cilia white, fuscous at apex. Underside of fore wing white, with

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Plate I.

Euxoa radians Guen.

Fig. 1—Eggs attached to leaf .. .. x 20
Fig. 2—Pupa (male) .. .. .. x 2
Fig. 3—Adult male .. .. Natural size
Fig. 4—Adult female .. .. .. Natural size
Fig. 5—Damage to cotton seedling by 1st instar larvæ.
Fig. 6—Damage to cotton seedling by 3rd instar larvæ.

Fig. 1

Fig. 2

PLATE I.—THE BROWN CUTWORM (*Euxoa radians* Guen.)

From Watercolour Drawings by I. W. HELMSING

small discoidal lunule and the terminal area suffused with fuscous; hind wing with rounded apical black patch. ♀ Usually suffused with fuscous, the markings obscure."

The only note to be added to the above description is that the cold weather forms are much more prone to having fuscous markings suffused than the hot weather forms, which are much lighter in general ground colour.

One female recovered in the cold end of the incubator was practically black all over.

Egg.

This is a typical noctuid egg, spheroidal and slightly flattened on one side. (Plate I., fig. 1.) The flattened part may be considered to be attached ventrally to facilitate description. Ridges radiate from the slight protuberance at the tip towards the flattened part. Thickened ridges encircle the egg longitudinally, cutting the radiating ridges at right angles. When newly laid the colour is milk white, but this changes to a light cream as the embryonic development proceeds. A reddish-brown spot then appears at the top, and a band of the same colour forms an equatorial belt round the egg. When about to hatch the dark head capsule and pro-thoracic shield of the larva can be seen through the shell, and the large clubbed setæ on the body can be plainly seen.

The head lies under the apex of the egg, where the micropyle is situated, while the body lies coiled underneath around the periphery.

Average weight	·0022 grams.
Average diameter	·6 mms.

Larval Instars.

In the descriptions which follow the nomenclature adopted by Ripley[8] has been used in the case of the chætotaxy, while he in his turn used the system of Fracker[9] with some additions.

Ripley (*loc. cit.*) considered that the chætotaxy and other features of the head capsule, and the characters of the spinneret, had taxonomic value in the noctuid larva examined by him. In the present bulletin these characters have been featured and the chætotaxy of the body segments marked out. This was done as the author has not yet seen any illustration from the genus "Euxoa" and because certain of the minute setæ which were in doubt have been clearly distinguished in the first instar larvæ and have been figured (Plate III.).

The epicranial index, i.e., the ratio between the length of the frons and the length of the epicranial stem $\frac{F}{ES}$ are given for each instar.

First Instar Larva (Plate II., fig. 1).

Head capsule width	·325 mm.
Epicranial index $\frac{F}{ES}$	$\frac{·13}{·05} = 2·6$.
Length	3 to 4 mm.
Crotchet formula for larvapods	$\frac{0}{0}\ \frac{4}{4}\ \frac{5}{5}\ \frac{5}{5}\ \frac{8}{8}$

Head capsule colour, dark brown. The chætotaxy of the head capsule is shown in Plate VI., fig. 1. This figure is given to contrast with the figure of the head capsule of the sixth instar larva (Plate VI., fig. 2).

Some outstanding differences between first and sixth instar head capsules apart from mere size are:—

First Instar.	Sixth Instar.
Relatively large setæ, particularly v2.	Setæ relatively small.
Adfrontal suture absent.	Adfrontal suture present.
Ocelli relatively large.	Ocelli relatively smaller.
Epicranial index—2·4.	Epicranial index—4·25.

The chætotaxy of the head of the first instar larva corresponds to the figures in Ripley's work apart from relative position. The only addition in this figure is a small sensorium near ocelli 1 and 2.*

This sensorium has been found in all noctuid larvæ examined and is difficult of observation because of its small size and position. We have named it S.V.4.

All the setæ except the minute ones on the head and body are clubbed, the clubbed ends being hollow. On the sur-anal plate are found the largest setæ, having a length of ·225 mm. and a width at the clubbed end of ·009 mm. The length of setæ α and β = ·16 mm.

There is no visible pigment in the skin of this larva but small protuberances at the base of the setæ are slightly chitinised, the chitin having a faint brown tinge.

The spinneret figured in Plate VII., fig. 3, is of a reduced type.

A general idea of the appearance of the larva is given in Plate V., fig. 5.

The thoracic legs are relatively large and on the first thoracic segment is the dark-brown pro-thoracic shield which is strongly chitinised.

Abdominal segments 1, 2, and 3 carry no larvapods. Those on segments 4 and 5 are very much reduced, while well developed ones are found on segments 6 and 7 and on the anal segment. The crotchet formula, or number of hooks present on each larvapod reading from front to rear is given at the beginning of this description. They are arranged in a uniordinal meso-series. The numbers vary and those quoted only give an example.

* This sensorium was first noticed by the artist, I. W. Helmsing, while drawing the head capsule of *Remigia frugalis*.

Plate II.

Euxoa radians Guen.

Fig. 1—First Instar Larva .. .. × 8
Fig. 2—Second Instar Larva .. .. × 8
Fig. 3—Third Instar Larva .. .. × 4
Fig. 4—Fourth Instar Larva .. .. × 4
Fig. 5—Fifth Instar Larva .. .. × $2\frac{1}{2}$
Fig. 6—Sixth Instar Larva .. .. × $1\frac{1}{2}$

Fig 2

Fig 3

PLATE II.—THE BROWN CUTWORM (*Euxoa radians* Guen.)

From Watercolour Drawings by I. W. HELMSING

Plate III. shows the arrangement of the setæ on all the segments of *Euxoa radians* first instar. On this larva are found all the setæ illustrated by Fracker in his figure of *Felta gladitoria,* and in addition the minute setæ xa, xb, xc, and xd figured by Ripley in his figure of the mature larva of *Cirphis unipuncta.*

In the case of *Felta gladitoria,* Fracker states: "On the prothorax, eta of the kappa group, all the tau group and sigma are wanting."

In the case of *Euxoa radians* first instar, all of these setæ are present, but are extremely minute.

Eta of the kappa group is shown in close association with kappa. Both tau and omega are present in the tau group. Sigma is present though minute, and is situated on the caudal edge of the coxa of each thoracic leg.

The minute setæ marked xa, xb, xc, and xd are present on the thorax as follows:—

xa is on the caudal margin of the prothoracic shield and xb near the cephalic margin of the mesothorax slightly dorsad of alpha. Both xa and xb are present close together on the metathorax in line with, and cephalad of alpha.

xc and xd are present as one group on the mesothorax, and on the metathorax in line with, and cephalad of epsilon, but further from the cephalic margin than xa and xb.

The prothoracic shield, strongly chitinised and dark brown, has three sensoria (s); two just caudad and dorsad of alpha and the third near gamma.

On the abdominal segments 1 to 8 inclusive are to be noted the three minute setæ x, epsilon, and omega, none of which appear in the illustration of *Felta gladitoria.*

On segment 9, epsilon is not present although x and omega are retained.

The homotypy of segment 10 is not clear, so is not fully annotated in the figure, the only named setæ being alpha, beta, kappa, and rho, on the sur-anal plate.

Second Instar Larva (Plate II., fig. 2).

Head capsule width	·52 mm.
Epicranial index $\frac{F}{ES}$	$\frac{\cdot 2}{\cdot 0}\frac{2}{9}\frac{5}{}$ = 2·5
Length of body	4 to 6 mm.
Crotchet formula of larvapods	$\frac{0}{0}\ \frac{4}{4}\ \frac{6}{6}\ \frac{6}{6}\ \frac{8}{8}$

Head capsule colour, light brown when newly moulted, darker later. Prothoracic shield light brown and not conspicuous. The setæ are relatively smaller than in first instar, and some additional "secondary" setæ are present.

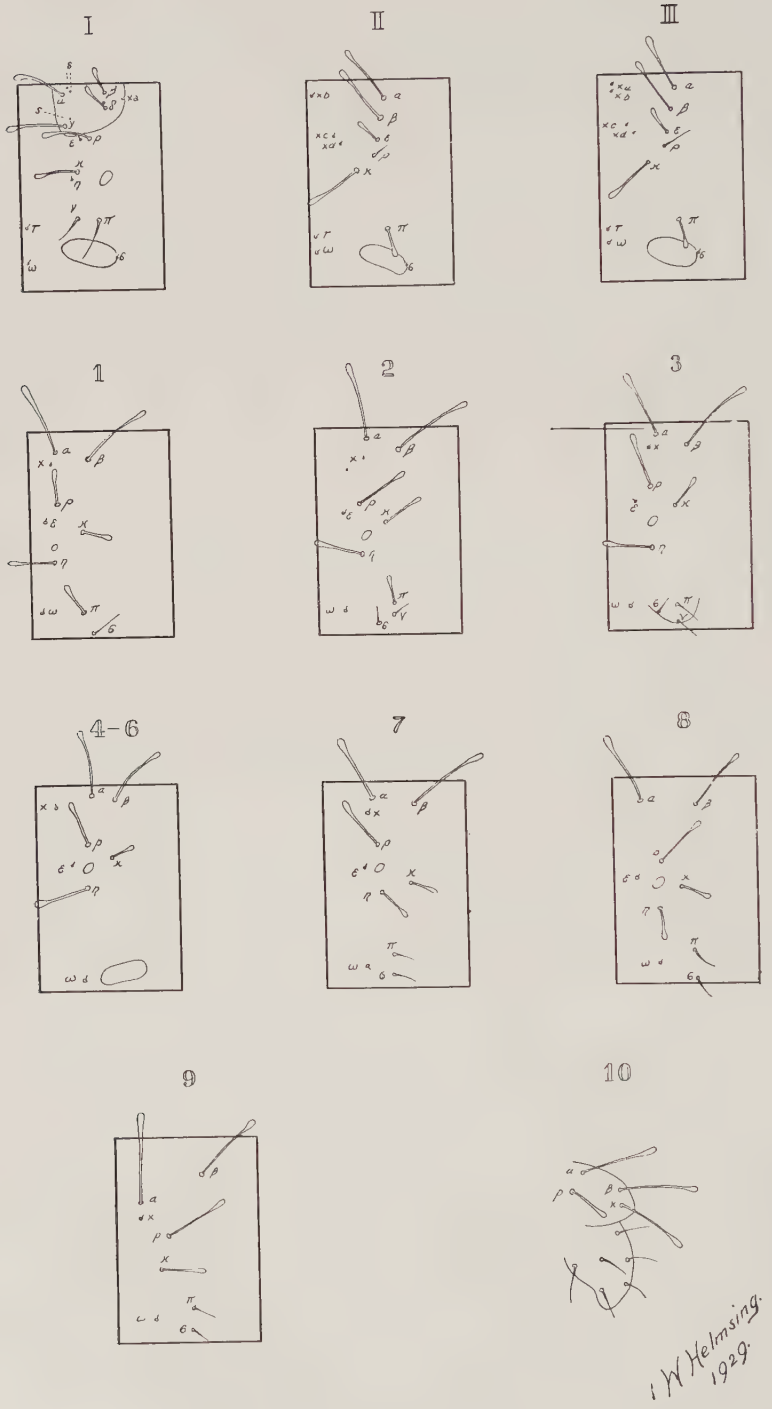


Plate III.

The chætotaxy is the same as in the sixth instar (Plate IV.), and differs from the first instar in the following particulars:—

First thoracic segment.—Substantially the same as in first instar, except some changes in relative position of setæ and the increase in size of sigma.

Second and third thoracic.—As in first instar, with the addition of theta and eta.

First abdominal.—Setæ the same as the first instar, with the addition of mu and nu in the pi group.

Second abdominal.—As first instar, with addition of tau and mu.

Third abdominal.—As first instar, with addition of mu and a larvapod which is still much reduced.

Fourth, fifth, and sixth abdominal.—As in first instar, with addition of mu.

Ninth abdominal.—As in first instar.

The larval skin has very little pigment, faint brown stripes running along the sides being discernible, but the green which shows in the larva is mainly due to the green food contained in the gut.

THIRD INSTAR LARVA (Plate II., fig. 3).

Head capsule width	·77 mm.
Epicranial index $\frac{F}{ES}$	$\frac{\cdot 3\ 0}{\cdot 1\ 2} = 2{\cdot}5$
Length of body	6 to 10 mm.
Crotchet formula of larvapods	$\frac{0}{0}\ \frac{4}{5}\ \frac{7}{6}\ \frac{6}{6}\ \frac{9}{10}$

Head capsule colour, brown. Skin light brown. When feeding, a dirty green colour is the result of the green material in the gut showing through. The larva illustrated had an empty gut and was ready to moult, so that its colour was lighter than the normal. The illustration clearly shows the disproportionate size of the head capsule relative to body size, of a larva ready to go into the next instar.

The wide separation of the two sides of the head capsule, showing the cervacoria, and the space between the back of the head capsule and the prothoracic shield, are both signs of an approaching moult. In larvæ not ready to moult the head capsule is usually partly withdrawn under cover of the prothoracic shield.

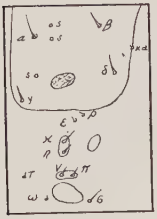
The chætotaxy is the same as in the sixth instar.

FOURTH INSTAR LARVA (Plate II., fig. 4).

Head capsule width	1·21 mm.
Epicranial index $\frac{F}{ES}$	$\frac{4\ 2\ 0}{1\ 5\ 0} = 2{\cdot}8$
Length of body	10 to 19 mm.
Crotchet formula of larvapods	$\frac{5}{7}\ \frac{11}{11}\ \frac{12}{13}\ \frac{14}{12}\ \frac{15}{15}$

Colour as in third instar, with a faint red suffusing the dorsum between the brown areas.

I



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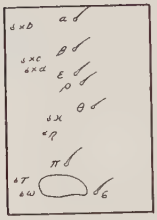

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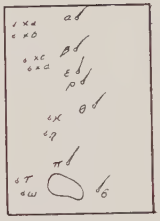

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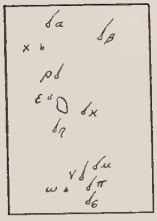

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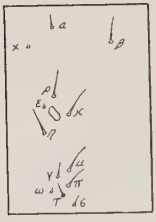

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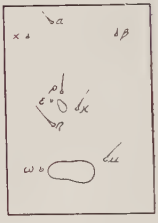

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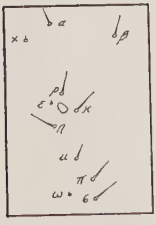

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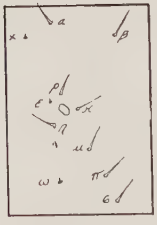

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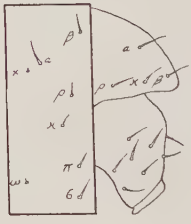


I. W. Helmsing. 1929.

PLATE IV.

Fifth Instar Larva (Plate II., fig. 5).

Head capsule width	1·89 mm.
Epicranial index $\frac{F}{ES}$	$\frac{\cdot 8}{\cdot 1}\frac{4}{6}\frac{0}{5} = 2{\cdot}9$
Length of body	16 to 26 mm.
Crotchet formula of larvapods	$\frac{8}{10}\ \frac{10}{12}\ \frac{11}{12}\ \frac{13}{12}\ \frac{13}{13}$

Colour as third instar and chætotaxy as sixth instar.

Sixth (Final) Instar Larva (Plate II., fig. 6).

Head capsule width	2·88 mm.
Epicranial index $\frac{F}{ES}$	$\frac{\cdot 8}{\cdot 2}\frac{5}{} = 4{\cdot}25$
Length of body	26 to 44 mm.
Crotchet formula of larvapods	$\frac{12}{13}\ \frac{15}{16}\ \frac{16}{17}\ \frac{17}{16}\ \frac{22}{23}$

The colour is a grey-brown often having a reddish tinge. The general colour in all stages when lifted from the soil is affected by the colour of the food in the food canal and by the soil in which the caterpillar is found.

The setæ are relatively large in the first instar but become relatively smaller with each successive increase in size of the larva, so that the sixth instar larva looks quite naked. The spinneret (Plate VII., figs. 1 and 2) is of the same reduced type all through the larval life history. The chætotaxy is illustrated in Plate IV., and is the same as that described in the second instar.

Dyar's Constant.

The Dyar's constant (i.e., ratio between the width of the head of one instar with that of the next instar) varied to some extent between the different instars, and the figures quoted below are the results of averaging 60 individuals.

Dyar's Constant.—Between first and second instars ..	— 1·6
Between second and third instars ..	— 1·5
Between third and fourth instars ..	— 1·57
Between fourth and fifth instars ..	— 1·56
Between fifth and sixth instart ..	— 1·52
Average for the species ..	— 1·55

Pupa. (Colour Plate I., fig. 2) and (Plate V., fig. 1.)

It is a typical noctuid pupa.

The average length of males and females was taken over one hundred individuals.

Females, average length	19 mm.
Males, average length	17·5 mm.

The range in the length of females during the experiment was from 17·5 mm. to 20 mm. and of males from 14·5 mm. to 19·5 mm. The average width of both sexes was about 6 mm.

Plate V., figs. 2 and 3, shows the difference between male and female pupæ in segments 8, 9, and 10 of the abdomen.

The cremaster on the anal segment has two strong, slightly hooked spines, and a variable number of smaller ones. One function of this organ has already been noted. The colour of the pupa is light amber at pupation, but darkens with age to a rich brown.

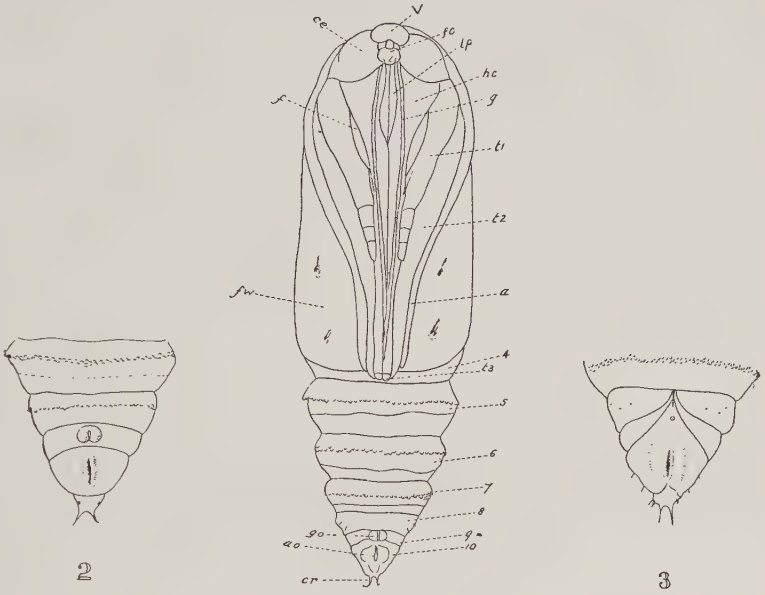
Plate V.

Euxoa radians Guen.

Fig. 1. Pupa anatomical details.
Fig. 2. Pupa ♂ terminal segments.
Fig. 3. Pupa ♀ terminal segments.
Fig. 4. Mandible of sixth instar larva.
Fig. 5. First instar larva lateral aspect x 15.
Fig. 6. Sixth instar larva lateral aspect x 1½.

Explanation of Fig. 1.

4-10. abdominal segments.
a. antenna.
ao. anal opening.
ce. compound eye.
cr. cremaster.
f. femur of prothoracic leg.
fe. fronto clypeus.
fw. forewing.
g. galea of maxillae.
go. genital opening.
he. cover of haustellum.
l. labrum.
lp. labial palpus.
t1. tibio-tarsus of prothoracic leg.
t2. tibio tarsus of meso thoracic leg.
t3. tibio tarsus of meta thoracic leg.
v. vertex.



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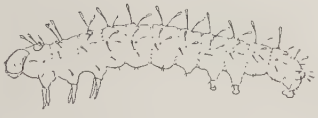

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I. W. Helmsing. 1929.

Plate V.

Plate VI.

Head capsules of noctuid larvæ.

Fig. 1. *Euxoa radians* Guen., first instar. Cephalic aspect of head.

Fig. 2. *Euxoa radians* Guen., sixth instar. Cephalic aspect of head.

Fig. 3. *Remigea frugalis* Fabr., last instar. Cephalic aspect of head.

Fig. 4. *Agrotis ypsilon* Rott., last instar. Cephalic aspect of head.

Fig. 5. *Spodoptera mauritia* Boisd., last instar. Cephalic aspect of head.

a. antenna.
a. 1-2. adfrontal setæ.
adf. adfrontal sclerite.
ads. adfrontal sensorium.
adt. adfrontal suture.
an. antocoria.
ar. antennaria.
c. 1-2. clypeal setæ.
cc. cervacoria.
cls. clypeo-labral suture.
cs. clypeal suture.
ea. epicranial arm.
es. epicranial stem.
f. frons.
fl. frontal setæ.
fcs. fronto-clypeal suture.
fs. frontal sensorium.
l. labrum.
l. 1-6. labral setæ.
md. mandible.
o. 1-3. occipital setæ.
oc. 1-6. ocellaræ.
pe. preclypeus.
po. post clypeus.
so. occipital sensoria.
sv. 1-4. vertical sensoria.
v. vertex.
v. 1-9. vertical setæ.

Plate VI.

Plate VII.

Fig. 1. *Euxoa radians* Guen. Sixth instar, distal portion of labium, caudal aspect x 60.

Fig. 2. *Euxoa radians* Guen. Sixth instar, distal portion of labium, cephalic aspect x 60.

Fig. 3. *Euxoa radians* Guen. First instar, distal portion of labium, latero-caudal aspect x 264.

Fig. 4. *Remigia frugalis* Fabr. Last instar, distal portion of labium, ventral aspect x 60.

hxs. hypopharyngeal setæ.
lp. labial palpus.
siw. lower lip of spinneret.
pp. palpiger.
sis. proximal sclerite of spinneret.
sio. proximal fold of spinneret.
sir. rudimentary fringe of spinneret.
spr. sensoria of palpiger.
sr. sensorium.
si. spinneret.
sp. stipulæ.
sps. stipular setæ.
smt. submental setæ.
sm. submentum.
siv. upper lip of spinneret.

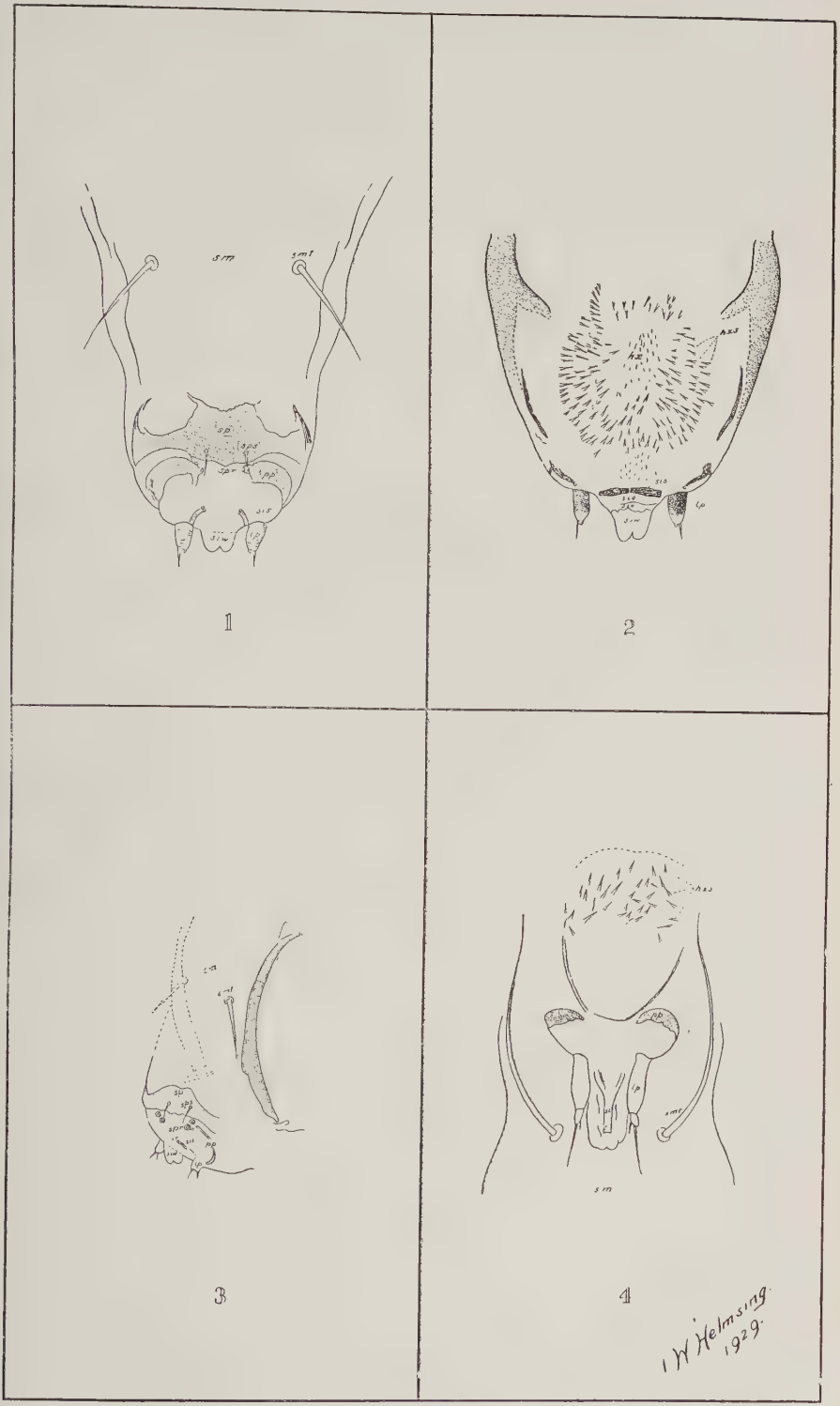


Plate VII.

COTTON GROWING IN QUEENSLAND.

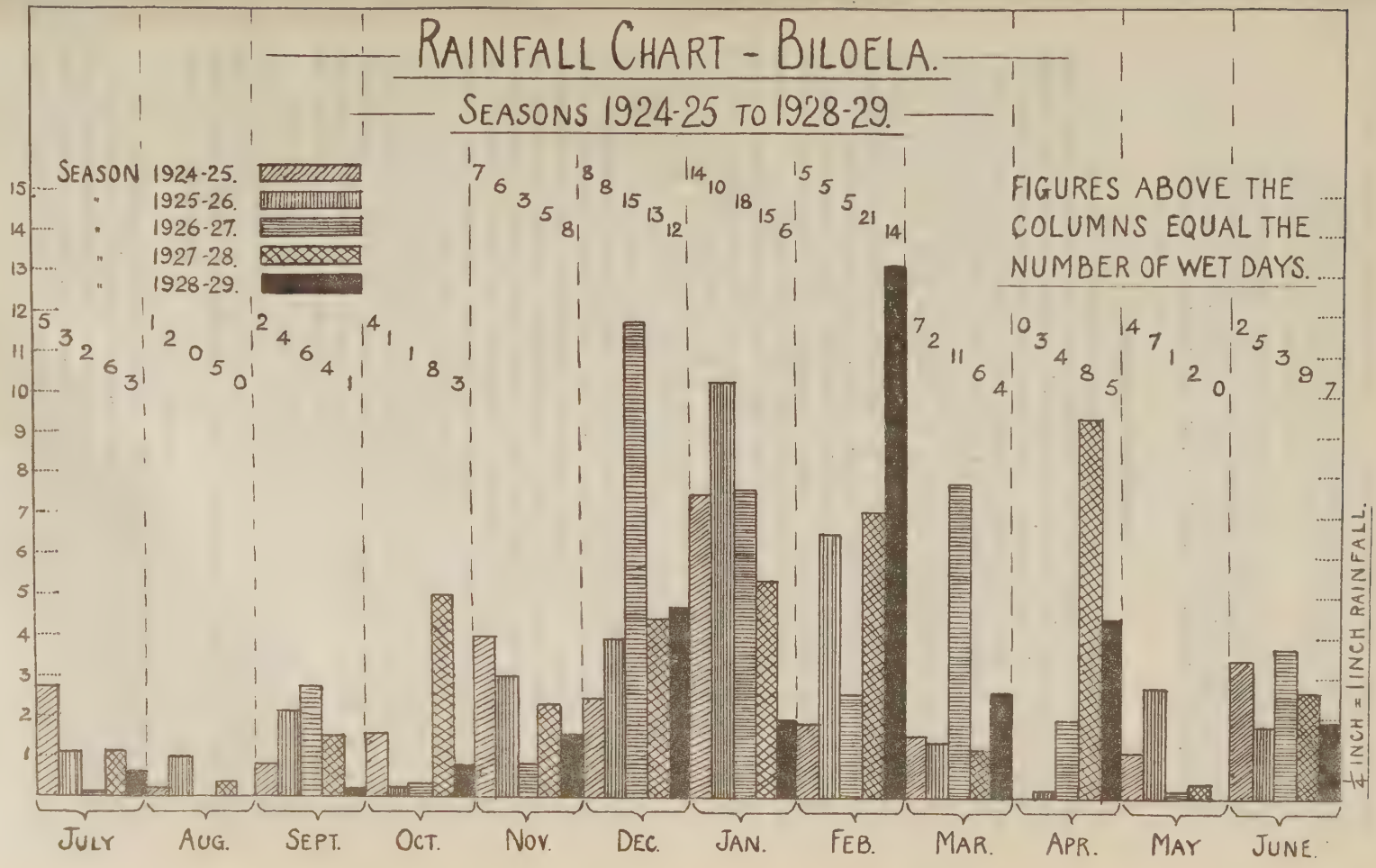
WORK AT THE CALLIDE EXPERIMENT STATION.

Subjoined are extracts from the last annual report of the Cotton Specialist, Mr. W. G. Wells, on the work of the Callide Cotton Experiment Station at Biloela. Mr. Wells discusses many matters of interest not only to cotton growers, but to farmers generally. His general review deals with experiments from which sufficient evidence has been obtained to permit of the drawing of some conclusions. Breeding operations are also described, and the incidence of insect pests reported.—Editor.

Summary.

THE results of the operations of this season are briefly summarised as follows:—

1. Early planting undoubtedly increases the possibilities of obtaining good yields on the average of the soils of the Research Station.
2. The results obtained by most of the growers in the surrounding district are in keeping with this statement.
3. By soaking the seed for three hours immediately before planting them, a clear twenty-four hours' gain in the period of germination may be effected.
4. Planting late-sown cotton in pairs of rows, 6 feet between the pairs, and 4½ feet between the rows of each pair, does not appear to be of advantage on the Station soils. Plant growth indicated, however, that on soils where very rank growth may be produced, this system should be investigated.
5. Planting cotton in widely spaced hills (3½ feet apart) as compared to planting in drills and then thinning to 2 feet apart, the rows being 4½ feet apart in each method, does not appear to be desirable either from the standpoint of yield or efficiency of cultivation.
6. Thinning late-sown plants when they are 6 to 8 inches high appears to be more advantageous than when they are either 10 to 12 or 14 to 16 inches high.
7. Late-sown plants spaced 1 foot apart in rows 4 feet apart appear to produce a greater number of flowers per acre than where the plants are spaced either 2 or 3 feet apart. This is also the case where the rows are spaced 4½ and 5 feet apart.
8. Such a plant-spacing is more susceptible to climatic variations, however, so the greater flower production may not indicate greater yield obtained. Plant growth indicated that possibly, under less adverse seasonal conditions, wider spacing of late-sown plants may be more beneficial.


RAINFALL CHART - BILOELA.
SEASONS 1924-25 TO 1928-29.
SEASON 1924-25.
1925-26.
1926-27.
1927-28.
1928-29.
FIGURES ABOVE THE COLUMNS EQUAL THE NUMBER OF WET DAYS.
5 3 2 6 3
1 2 0 5 0
2 4 6 4 1
4 1 1 8 3
7 6 3 5 8
8 8 15 13 12
14 10 18 15 6
5 5 5 21 14
7 2 11 6 4
10 3 4 8 5
4 7 1 2 0
2 5 3 9 7
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
JAN.
FEB.
MAR.
APR.
MAY
JUNE.
1/4 INCH = 1 INCH RAINFALL.

9. Applying fertilisers as top dressings when the plants are well established and the early summer rains have started may be of more advantage than putting the fertilisers into the drills before or at planting time.

10. The corn-ear worm is undoubtedly one of the most serious problems the Queensland farmer with late planted rankly grown cotton has to solve. The early planting of cotton, however, appears to offer a decided measure of protection from this pest.

Seasonal Conditions.

The seasonal conditions under review have undoubtedly been the most unfavourable for cotton-growing of any experienced since the Station has been established. Following a total of 2·57 inches of rainfall in June, well-prepared seed-beds were obtained in all of the plots. Unfortunately, only three light showers yielding a total of ·43 inches occurred during July, and no rain fell at all in August. Such conditions dried out the upper surface of the seed-beds to such an extent that good rains were necessary to enable a satisfactory strike being obtained. It was impossible, therefore, to plant on the showers in September and October, although, in areas within a few miles where the precipitations were of a heavier nature, good germinations occurred in sandy or loamy soils. Sufficient rain to enable a strike to be obtained did not occur until 5th November, when ·90 of an inch fell. Unfortunately, no further rain fell until the 19th, so that any irregularities in the depth of planting badly affected the rate of germination, as such a light precipitation evaporated very quickly under the conditions of high maximum temperatures which existed during that period. Good rainfall was experienced early in December, which enabled excellent strikes to be obtained. Showery conditions prevailed from then on to the 25th of the month, after which a dry period accompanied by very high maximum temperatures existed until the 12th January. Scattered light showers occurred from this date until the 7th February, but high temperatures were maintained throughout most of the period. A spell of continuous showery conditions was then experienced until the 23rd of the month, when a long period of hot dry weather again set in, which was unbroken, with the exception of a storm yielding 91 points of rain on the 18th, until the 28th of the month. A good fall occurred then, followed by further rains during the first four days of April. This wet spell terminated the unusually long period of abnormally high maximum temperatures which existed with only slight interruptions from the first of January. With the cooler weather, dry conditions again prevailed and an excellent harvesting period ensued until the middle of June, after which a few light showers occurred.

Killing frosts occurred on the 28th, 29th, and 30th April which destroyed all top growth. Rather low temperatures were then experienced until the 24th May, when a period of four nights of severe frosts was experienced which completely froze all unopened bolls of a size less than half developed.

Cotton.

The yields as a whole have been the lowest that have been obtained on the Station. In many of the plots where very heavy yields have always been obtained, no picking was made this season. The explanation lies in the late planting, followed by an unusually wet February and a series of very severe corn-ear worm attacks.

The rain of the 5th November was just sufficient to obtain a strike under conditions of absolute proper depth of planting and covering of the seed. As some time elapsed before further rain fell, a very irregular rate of germination occured in most plots, and under the existing high temperatures many of the later appearing seedlings died off. This feature was reported generally by the farmers throughout the district who planted on the same rain. Following on the rains of the 4th and 5th December the ungerminated seed in the November planting sprouted. This resulted in a very uneven growth of plant, many of the plots by the end of January having plants 3 feet high adjacent in the same row to the later germinated plants which were only 12 to 18 inches high. This may explain the low yields and rather high degree of corn-ear worm attack which was experienced in the November plantings on the Research Station. In the farmers' crops in the portions of the district where a heavier fall of rain occurred on the 5th November, much better yields were obtained and decidedly lighter corn-ear worm attacks were experienced. Likewise, in previous seasons early November plantings on the Station have given good yields.

The plants made fairly satisfactory growth up to the end of January over the whole of the Station, the early December plantings looking particularly promising. However, under the influence of the two long-pronounced wet periods which occurred in February, nearly all plantings showed a decided tendency to produce an excessive vegetative growth. The situation was further complicated by the high temperatures and dry period which existed during the first half of March. The succulent vegetative growth reacted to such severe conditions, and considerable square shedding occurred. The plants gradually toughened up nicely, however, and might have eventually developed a good crop but for the wet period which occurred from the 27th March to the 4th April, during which around 6 inches fell. This caused a general "bolting" of the plant growth, with the result that much of the Station's crop averaged 5 to 6 feet in height. Corn-ear worm attacks during the latter part of March and early in April further aggravated the tendency to excessive growth. The result of such a combination of adverse conditions, together with early killing frosts, was that the total crop over the whole of the Station was picked by the 8th June, fully a month earlier than usual.

An interesting example of the effect that the condition of the soil may have on the cotton plant was noticed on several low-lying portions of the Station, where the heavy rains caused an accumulation of water for periods of a day or two at a time. In such locations the plants were of a light yellowish green as compared to the dark rich green of the plants over the rest of the Station. They were also shorter and bore very good to even heavy crops of cotton of good quality.

This checking of the growth of late-planted cotton by partial water-logging of the soils has been noticed before on the heavier clay soils in both this valley and in the Wowan and Dululu districts. A sort of physiological drought effect on the plant is produced, which controls the growth to a marked extent and thus allows profitable crops to be produced when the contrary would be expected. Similar results were also obtained this season on the irrigation project at Theodore. There, where the late November crops on clay soils received a heavy soaking irrigation in mid-January, the plant growth was of only moderate development, and much heavier crops were produced than on crops of similar date of planting in the Callide Valley. This was particularly so if the cultivation following the irrigation was unduly delayed. The same

result was not obtained, however, on the rich alluvial loamy soils at Theodore. One late-planted crop on such soil was inspected which had only a few scattered diseased lower bolls. A very rank succulent growth had developed there under the wet February conditions, and an attack by the corn-ear worm had practically destroyed all of the squares formed over the rest of the season.

Fodder Trials.

The testing of different fodder crops to determine which are the most suitable for inclusion in rotation with cotton-growing has again received considerable attention.

As has been pointed out in previous annual reports of the Station, the growing of a winter crop of wheat offers a fairly assured supply of hay of good quality and feeding value. This crop also provides a supply of green feed for the dairyman at the time when the natural grasses have lost much of their food value. Accordingly, varietal tests were again conducted along the lines of the experiment of the previous year, only that the Warren variety was substituted for Warden on account of the susceptibility of the latter to losses from smut.

The following table shows the data obtained from twenty one-sixtieths of an acre plots of each variety; the varieties are arranged in pairs with Florence as the standard in each comparison:—

Variety.	Mean Yield of Sun-Dried Hay in lb. per $\frac{1}{60}$ acre.	Mean Difference.	Value Z.	Odds of Difference being Significant.
Florence	44·19 lb.	2·21	·62	About 150 to 1
Warren	46·4 lb.			
Florence	40·84 lb.	·39	·09	Less than 2 to 1
Roma Red	41·23 lb.			
Florence	48·335 lb.	1·46	·39	19·5 to 1
Warchief	46·86 lb.			
Florence	44·31 lb.	22·86	7·03	More than 10,000 to 1
Skinless Barley	21·45 lb.			

The results of the experiment would indicate that again Skinless Barley has been decidedly inferior to the varieties of wheat tested, as a hay producer. They also indicate that under the seasonal conditions there was no significant difference in the yields obtained in the different wheat variety comparisons except in the Florence-Warren test. In this case, while the difference per plot was small, the statistical treatment by the "student method" gave a very clear indication that under the seasonal and soil conditions Warren was the better of the two varieties, the odds being 150 to 1. As odds of 30 to 1 are considered to be indicative that there is a significant difference in the yielding abilities of two varieties, it can be seen that the results of this comparison were fairly conclusive.

The mean yields of all varieties in the test were decidedly lower than those obtained in the experiment of the previous season. This can be explained by the limited quantity of rainfall which fell during the growth of this experiment as compared to the previous one. Planting was effected on the 23rd June following which 93 points of rain fell

in July in three scattered storms, 17 points in September, and 6 points in October, a total of 1·59 inches during the growing period. A thorough soaking of the seed-bed was obtained soon after the ploughing in April, and 1·64 inches fell in scattered storms during June prior to planting, otherwise it is doubtful if such yields would have been obtained. The previous experiment experienced much better conditions, being planted soon after heavy rain fell early in June, and received 4·56 inches during the growing period, much of which fell when the crop was in the stage of growth requiring ample moisture.

Under the conditions in which this season's experiment was grown, the early maturing variety, Warren, gave good results, and, had the test been planted a fortnight earlier and obtained more benefit of an inch fall then, it is possible that this variety would have showed to better advantage.

Maize.

The testing of maize varieties was again conducted during the past season. The results of the test of the previous season indicated that Improved Yellow Dent obviously required too long a season to be a satisfactory maize for the Callide Valley. Accordingly, only Star Leaming, Funk's 90-day, Reid's Yellow Dent, and Golden Beauty were tried out this season.

Planting was effected on the 14th December and a satisfactory growth was made until the dry heat wave of January was experienced. This decidedly checked the growth of the plants until in all varieties only a stunted weakly stalk was obtained. Under the heavy February rainfall, fairly satisfactory grain was obtained, however.

The results of the experiment, which was in the form of a "Latin square," indicated that there was no significant difference between the yields of any of the four varieties. Star Leaming was the highest yielder (42·4 bushels per acre), and Golden Beauty was the lowest (41·25 bushels per acre).

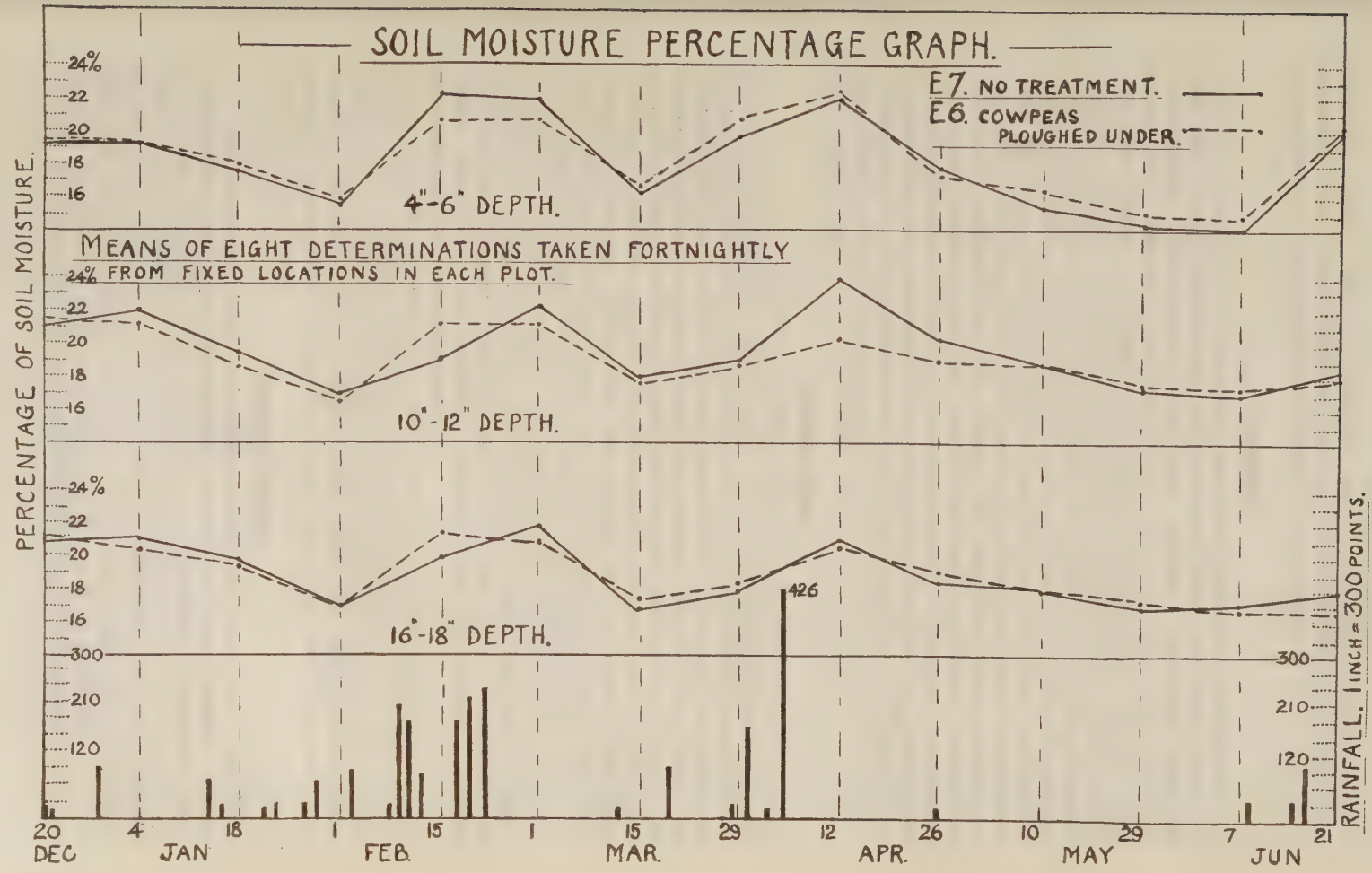
Summer Fodder Crops.

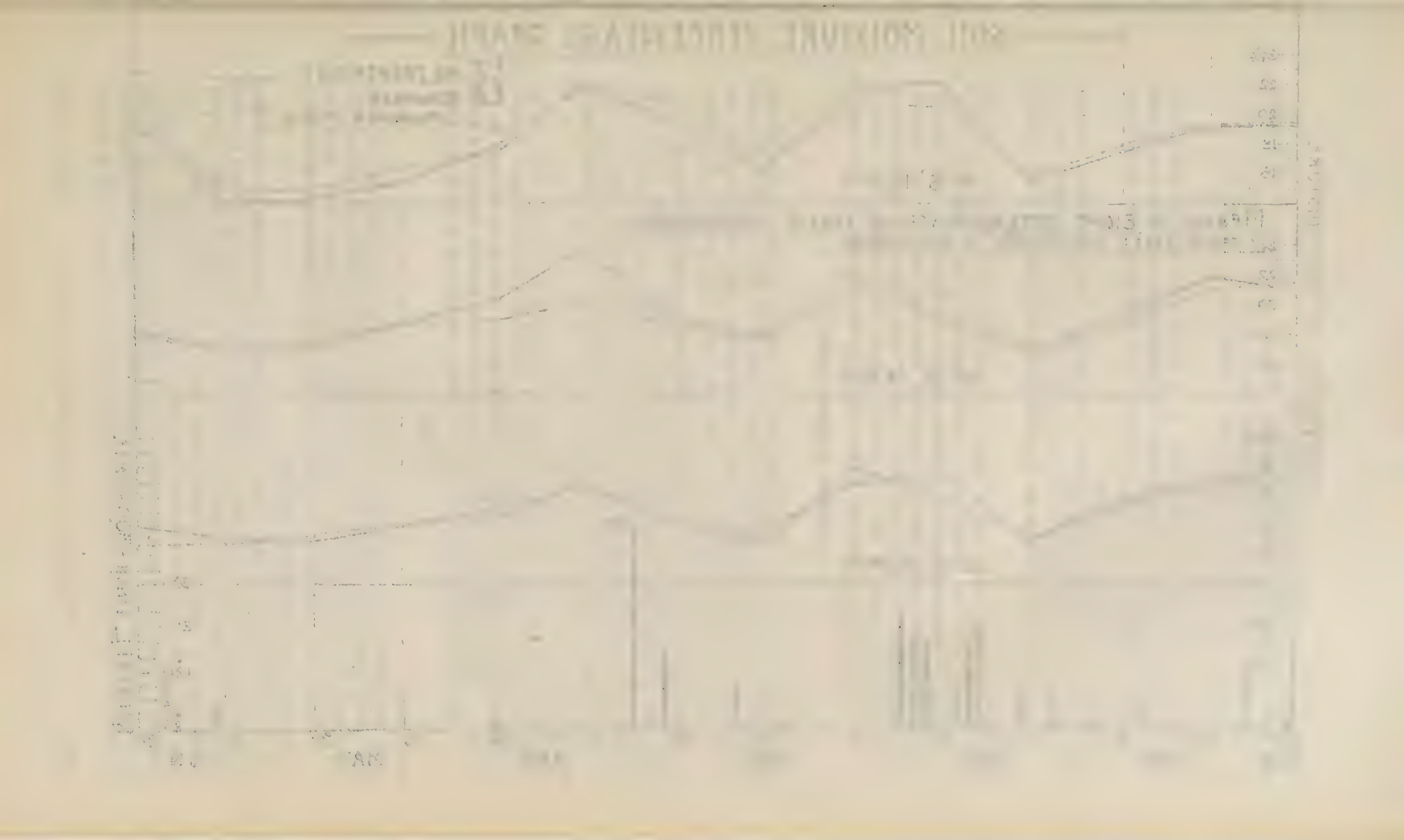
The reliability of the occurrence of the wet season during the months of December, January, and February makes the growing of quick-maturing fodder crops in this period one of the most assured sources of obtaining ample fodder supplies that the cotton-grower in the Callide Valley has. Different crops of this nature are tested out on the Station each season, and the results have always indicated that giant panicum, saccaline sorghum, and Sudan grass can always be relied upon to yield fairly well.

During this past season the plantings of giant panicum made rather slow growths during the dry weather in January, but developed rapidly during the wet weather in February, and yielded on the average around 2 to 2¼ tons of dry hay per acre.

The plantings of saccaline sorghum were mostly on the droughtier soils of the Station and consequently were effected by the dry conditions in January. In spite of this, yields of 12 to 14 tons (green weight) of fodder were made per acre.

Several varieties of Nigerian grain sorghums were also tested for the Instructor in Agriculture of the Central District, but none reached the stage of maturity. It would appear that the combination of a short


SOIL MOISTURE PERCENTAGE GRAPH.
E7. NO TREATMENT.
E6. COWPEAS PLOUGHED UNDER.
4"-6" DEPTH.
MEANS OF EIGHT DETERMINATIONS TAKEN FORTNIGHTLY FROM FIXED LOCATIONS IN EACH PLOT.
10"-12" DEPTH.
16"-18" DEPTH.
PERCENTAGE OF SOIL MOISTURE.
24%
22
20
18
16
300
210
120
426
RAINFALL. 1 INCH = 300 POINTS.
20 DEC
4 JAN
18
1 FEB.
15
1 MAR.
15
29
12 APR.
26
10 MAY
29
7 JUN
21



growing season, and the possible "new place effect" which is often associated with newly imported plants, makes these sorghums of somewhat doubtful value for the Callide Valley conditions.

Lucerne.

The 6-acre plot of this crop gave five cuts during the season, and did fairly well considering the periods of long dry spells which it encountered. Unfortunately, this crop appears to be highly attractive to the early broods of the moth of the corn-ear worm. In each of the past two seasons a migration of large numbers of the corn-ear worm from the lucerne to adjacent cotton plots has taken place. Fortunately, both of these have been noticed early in the day of the commencement of the migration. The laying of a poisoned bait of moistened bran and paris green in a furrow between the lucerne and the cotton, and dusting the infested cotton plants on the ends of the rows with calcium arsenate, effectively controlled the migration. The fact that lucerne is such an attractive breeding place for the first of the large broods makes it of somewhat doubtful value to the cotton-grower. Unless he is prepared to watch for the occurrence of such migrations and have materials which will enable him to control them as quickly as they occur, it is likely that much damage may be encountered by growing lucerne in the vicinity of a cotton crop.

Rhodes Grass.

The 11-acre paddock of Rhodes grass has again demonstrated its value. This was sown in January, 1927, in cultivated land of such droughty nature that cotton crops could not be profitably grown on it. Fortunately, good rainfall was experienced in that month and again in March, so that a very good growth was obtained in the first year. The crop was allowed to mature itself in order to have plenty of seed distributed to replant some misses occasioned by washing during the heavy storms in January. From the late months of that winter until now, fourteen heavy draught horses have had access to this plot, and have been kept in splendid condition with a light supplementary ration of maize and lucerne chaff whenever they were working. Even during the late winter months when the upper parts of the plants are badly frosted a green shoot has been present around the base of the stools, and the horses have fed in the paddock, although they had access to a large adjacent area of natural grasses.

It is believed, therefore, that every cotton-grower in the district should experiment with a small plot of this grass. The plot on the Station is on forest soil of clayey droughty nature, and, if such results can be obtained on it, it would appear that this crop offers a cheap source of green food during the period when the native grasses have lost their food value.

Rotation Series.

The results obtained from this series of crop tests have been very disappointing this season as regards yields in the cotton borders. Owing to the late planting and irregular rate of germination, excessive plant development occurred, which was aggravated by loss of crop from attacks by the corn-ear worm. All of the yields of cotton were unprofitable, and were so low that the effects of the cotton crops on the different systems of rotation will probably not be truly representative. The various rotations will be continued during the coming season, however, along the lines which have been planned.

Cotton Experiments.

The majority of the experiments of this season have been badly affected through irregular time of germination, terminal loss, hail damage and, in most cases, corn-ear worm attack. The yields in many have therefore been of little value and have not been considered. In some of such experiments, however, the plants of the first germinations developed fairly normally and it appeared possible to obtain some information on such characters as average boll weight, number of 4- and 5-locked bolls per plant, &c. This was deemed desirable in order to add to the data being collected in the different experiments, many of which are being conducted over a series of years. These have been fully described in previous annual reports of the Station, so only the data obtained this season will be discussed in an experiment.

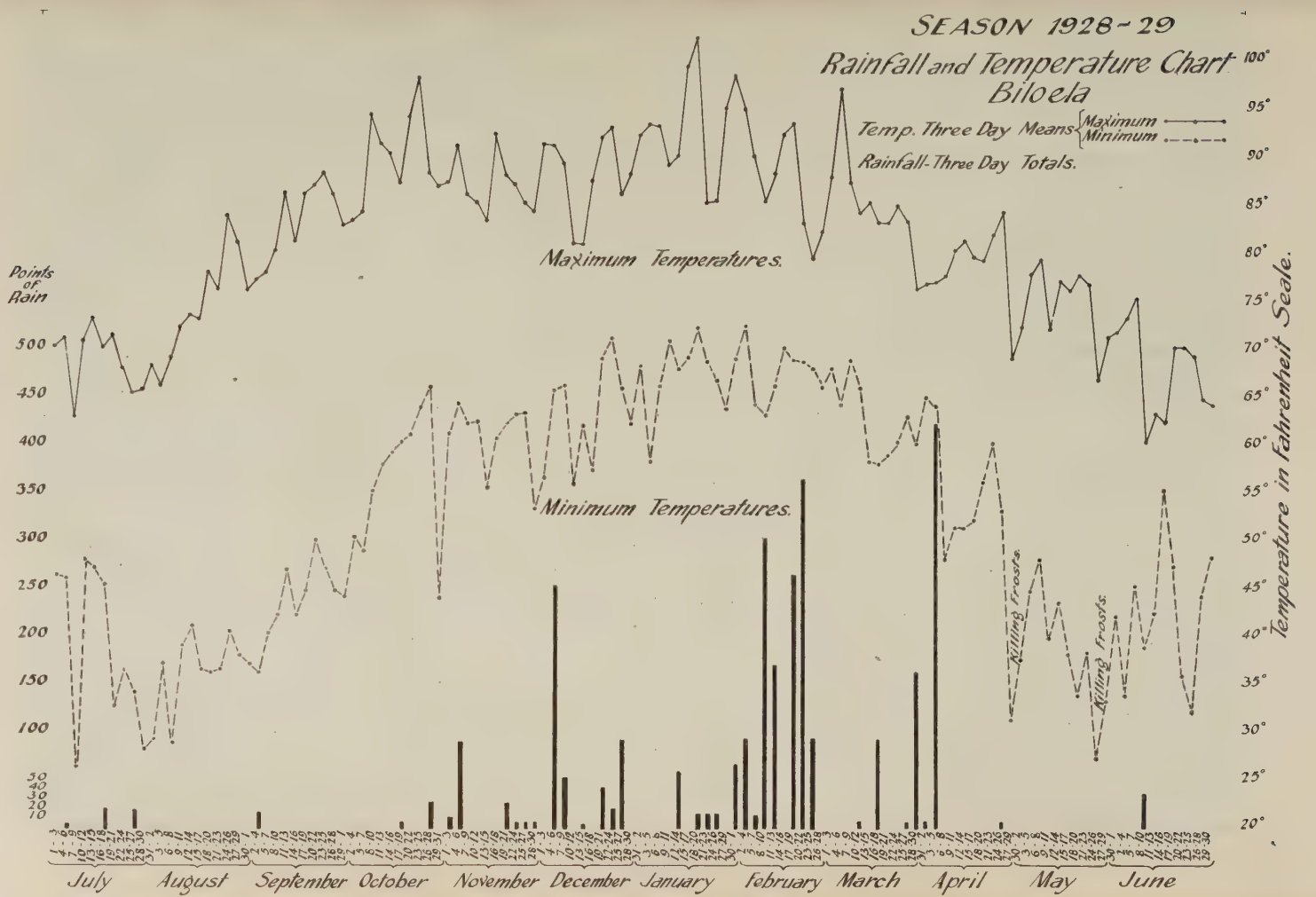
The method used this season to obtain material for examination was to select a number of plants in comparable positions in each border. These locations were spaced at regular intervals on a staggered basis in the three inner rows of each plot of each treatment. The only selection exercised was when the plant at the selected position number had lost its terminal or was adjacent to a blank space, in which case the nearest suitable plant with a terminal was taken.

Time of Planting Experiment.

The adverse climatic conditions prevented the regular programme of monthly plantings, starting in September, from being carried out in the first two months. Accordingly the experiment was re-designed so as to compare early and late November plantings with early and late December ones. Only one November planting was obtained, however, that being made on the 8th of the month. One planting was obtained on the 11th December and another on the 19th of that month.. Unfortunately a delayed complete germination was obtained in the November planting, so the yields are not really true indicators of the possibilities of an early November planted crop on the Station soils.

The early December rains allowed of a good strike being obtained for that month's plantings of the experiment. Rapid growth was made in the two earlier plantings during December, but under the prolonged period of high temperatures during early January the plants toughened up and gave excellent promise of producing profitable crops. The plants of the 11th December sowing were of an especially fine type, and by the end of January were easily the most promising of any ever produced in the December plantings on the Station.

The November planting flowered considerably earlier than did the later ones, flowering being fairly regular by the 6th February in the former whereas it was not until the 18th of the month that flowers in any quantity could be seen in the later sowings. The flower counts for February indicate that the early December planting produced only 25 per cent. as many as did the November planting, and the late December produced only 8 per cent. During March the figures improved, but even then the early December planting produced only 51 per cent. as many flowers as did the November one, while the late December sowing produced only 38 per cent. of the production of the earliest planting.


SEASON 1928-29
Rainfall and Temperature Chart
Biloela
Temp. Three Day Means {Maximum / Minimum
Rainfall-Three Day Totals.
Maximum Temperatures.
Minimum Temperatures.
Killing Frosts.
Killing Frosts.
Points of Rain
500
450
400
350
300
250
200
150
100
50
40
30
20
10
100°
95°
90°
85°
80°
75°
70°
65°
60°
55°
50°
45°
40°
35°
30°
25°
20°
Temperature in Fahrenheit Scale.
July
August
September
October
November
December
January
February
March
April
May
June

Generally speaking, by the 20th of February the November plants were carrying a nice crop of bolls and squares. Following the rainy season, however, excessive vegetative growth developed, which in conjunction with the severe corn-ear worm attack caused nearly a complete loss of squares and even the destruction of most of the lower bolls. Bolls started opening by the beginning of March, but it was not until the 21st of the month that opening was general. The plot was not picked until the 18th May in order to obtain all of the crop in the one picking. The yield was at the rate of 167 lb. per acre.

The 11th December planting entered February in excellent condition, and had only moderate rainfall been experienced in that month it is possible that this planting would have yielded heavily. The excessive rainfall of February, however, forced a very luxuriant growth in this planting, with the result that square shedding was severe. A very heavy corn-ear worm attack was also experienced during February, March, and April, so that practically no bolls set over the upper portions of the plants. The crop of bolls developed was so light that no picking was made until the 7th June, when a yield at the rate of 81 lb. per acre was obtained.

The late December planting was practically an entire failure with only a few scattered open bolls which were not harvested.

The results are in keeping with those obtained in the Time of Planting Experiment of previous seasons. While the November planting was made early enough to have given much heavier yields, the delayed germination really gave plant growth more similar to late November plantings of previous seasons. Comparable returns were also obtained by farmers on similar soils adjacent to the Station. In contrast to these, however, excellent yields were obtained within a few miles of the Station. These sections received storms during the latter half of October which allowed planting to be accomplished, and the early November rains thoroughly established the seedlings. The results over a series of seasons, therefore, indicate that September and October plantings offer the best chances of obtaining profitable yields in the Callide Valley.

The growers should make every effort, therefore, to establish early well-prepared seed-beds in order to be able to obtain a strike on the first planting rains of the season. The figure in this report illustrating the monthly rainfall at the Research Station for the last five seasons clearly indicates that sufficient rain occurs in June to enable a seed-bed to be prepared during that month. It is believed, therefore, if the growers plan their operations so as to enable ploughing to be done in early July, that much of the difficulty of obtaining early strikes will be overcome. Certainly, seasons will occur, such as this past one, where even well-prepared seed-beds will not allow of obtaining a strike owing to scanty rainfall. It is pointed out, however, that this is the first season in the six that the Research Station has been established, in which it has not been able to obtain a strike in late September or early October on early well-prepared seed-beds. An examination of the rainfall figure will show that the precipitations have been very light in September, so it is believed that early planting can usually be accomplished if the proper methods are used. As early planting seems to be correlated with heavy yields and escape from corn-ear worm attacks, it is believed that this is the key-point to successful cotton-growing in the Callide Valley.

Hill versus Drill Planting Experiment.

The merits of planting cotton in hills wide enough apart to allow of cross-cultivation, as compared to the usual method of planting in drills and later thinning out the plants to a distance of 2 feet apart, is of especial interest in a season like the one just completed. In the previous season the experiment on this subject was planted early and gave promise of yielding some interesting information. Unfortunately, through a misunderstanding at harvesting time, the plot was picked in such a manner as to make the yields obtained of little value.

The flower counts of that experiment clearly indicated, however, the yielding possibilities of the two systems. During the first 12 days of the flowering period which commenced on the 19th December, the single plants in the hills which were spaced 3½ feet apart in rows 4½ feet apart produced only 58·3 per cent. as many flowers as did the 2-foot spaced single plants in the same row spacing. During January the wider spaced plants gained somewhat, but still produced only 73·4 per cent. as many flowers as did the other treatment. The wet conditions in February accelerated the growth of the larger plants, however, with the result that they produced about the same number of flowers as did the 2-foot spaced plants. The flowering in the wider spaced plants fell off after this, only 94·8 per cent. as many flowers being produced in March as in the closer spacing.

The experiment of this season was planted 32 days later than was the one of last season. This caused a delay in the start of general flowering until the 21st of January as compared to the 19th December in the previous experiment. The wide-spaced plants did not produce as many flowers as did the closer-spaced ones in any of the three months in which the observations were taken. The numbers of flowers of the wide-spaced plants were of the following percentages of the 2-foot spaced plants:—January 47·3 per cent., February 72·0 per cent., March 70·2 per cent. These compare with the following percentages for the preceding season:—January 73·4 per cent., February 101 per cent., March, 94·8 per cent. It would appear, therefore, that the 3½-foot spacing between the plants was not as conducive to producing flowers per given area of row as was the 2-foot spacing. It would also appear, for the two seasons under review, that, when the crop is planted late and experiences a wet season, the difference in flower production between the two spacings is all the more pronounced than when the crop is planted early.

Owing to the severe maize-grub attacks which were experienced in this section of the Station, the yields were so low that no reliable data could be obtained from them. A portion of the plots where sufficient cotton was present as to afford some idea of the yielding abilities of the spacings was picked, however, although simply as a bulk picking of six short rows of a total area of approximately one-eighth of an acre of each treatment. It is recognised that such data are of little value, but the fact that in these two plots the 2-foot spacing yielded 100 per cent. heavier, being at the rate of 832 lb. per acre as compared to 416 lb., would indicate that probably the closer spacing would have produced at a heavier rate over the whole of the experiment but for the maize-grub attack.

In order to afford material for an examination of the effect of the spacings on the individual plant, 30 plants were selected, in the manner as previously described, in each treatment in the plots which were harvested.

The table records the data obtained from the material collected.

Data referring to Boll Formation and Weight of Bolls (Grammes) in Hill versus Drill Planting Experiment.

	Drill.				Hill.			
	Mean.	P.E.	S.D.	P.E.	Mean.	P.E.	S.D.	P.E.
Number of 5's ..	4·8	± ·35	2·82	± ·25	5·27	± ·35	2·82	± ·25
Number of 4's ..	6·4	± ·47	3·8	± ·35	6·03	± ·40	3·27	± ·28
Green 5's	·53	± ·09	·72	± ·06	1·13	± ·20	1·65	± ·14
Green 4's	7·6	± ·70	5·7	± ·50	6·6	± ·60	4·54	± ·40
Total number of bolls	24·47	± 1·02	8·32	± ·72	23·87	± 1·24	10·06	± ·88
Total S/c. per plant ..	91·28	± 4·34	35·21	± 3·07	85·99	± 3·39	38·88	± 4·79
Number of bolls per lb. S/c.	72·75	± 1·62	13·19	± 1·15	75·33	± 1·07	8·68	± ·76
Average weight 5 ..	6·94	± ·12	·92	± ·08	6·59	± ·11	·92	± ·08
Average weight 4 ..	6·07	± ·12	·92	± ·08	5·36	± ·20	1·59	∓ ·14
Dif. average weight of 5 and 4-locked bolls = ·87 ± ·17 grammes. $\frac{D}{E} = 5{\cdot}1$					Dif. average weight of 5 and 4-locked bolls = 1·23 ± ·23 grammes. $\frac{D}{E} = 5{\cdot}35$			

The data would indicate that there was no significant difference between the two spacings in any of the plant characters examined. In each treatment, however, the average weight of a 5-locked boll was significantly greater than that of the 4-locked boll. The difference was greater in the hill spacing, but this may have been caused by the considerably higher variation between the plants in this treatment, the coefficient of variability* being approximately twice that in the drill spacing.

The notes taken during the growth of the experiment indicate that the plants in the hill treatment had a heavier vegetative development and tended more to lodge. This latter feature was present last season in both a similar experiment and one in which different numbers of plants were left in hills spaced 3½ feet apart. This tendency to lodge prevents close working to the plants in the later cultivations, and thereby defeats the purpose for which the wide spacing is intended. Based on the results obtained for the two seasons it would appear questionable if there is any advantage to be gained by such wide spacing of the plants, as far as cultivation is concerned, and it may be possible that lighter yields will be obtained if this practice is followed.

Height of Thinning Experiment.

This experiment was planted following on the rain of the 8th November, but unfortunately suffered a variable germination in common with the rest of the plantings at this date. The yields, therefore, are of little value, although those obtained from two "Latin Squares" of this experiment indicated that the latest thinning produced the lowest yield. The variation in age of the plants makes the yields unreliable, however,

* Coefficient of variability $= \frac{SD \times 100}{M}$

so only the flowering data and the material from 60 selected plants in each treatment will be considered. The plants were selected by the method previously described, so it is believed that the results are truly representative of the three treatments under the conditions in which they were grown.

The thinnings were performed when the plants were 6 to 8, 10 to 12, and 14 to 16 inches tall, to a distance of 24 inches apart, one plant to a space. Observations on the 24th January gave the impression that little difference existed between the two earlier thinnings, but the effect of the delayed thinning during the favourable growing conditions in December had given the 14 to 16 inch thinning a decided "spindly" appearance, with practically no bottom crop. The effect of the prolonged high temperatures and lack of rain was noticeable in all three treatments, the fruiting branches produced during that period showing a decided shortening of length of internodes as compared to the rather long internodes produced during the luxuriant growing conditions.

Owing to the variation in stand and the loss of terminals from a hailstorm, it was believed that the usual flower counts in the centre rows of each plot would be of little value. In an effort to obtain as much information as practicable on this factor, it was decided, therefore, to select 20 plants in each plot of each treatment by the same method as was used in selecting the plants from which to obtain material for boll weight determinations, &c. Accordingly, daily flower counts were made on 120 plants in each treatment, and the following data were obtained:—

Flower Counts of Height of Thinning Experiment.

Treatment Height.	30th January to 28th February.	Per Cent of Total.	Rest of Season to 4th April.	Total.	Percentage based on 6 to 8 as 100.
6 to 8 inches	3,147	61·5	1,979	5,126	100
10 to 12 inches	2,641	56·3	2,049	4,690	91·5
14 to 16 inches	2,129	53·5	1,851	3,980	77·8

It would appear, as was the case last season, that the earliest thinning was conducive to an early formation of the fruiting branches and thus allowed of a heavier production of flowers during the first period of flowering. In the previous season this advantage was overcome, however, as the later thinnings produced higher total numbers of flowers for the season. The explanation of such a result appeared to lie in the fact that, under the favourable seasonal conditions during the early growth of the plants, a rather vegetative development occurred in the early thinned plots. Considerable shedding of squares took place on this growth during unfavourable conditions in January and February, which thereby reduced the later flowering. There was a tendency to produce flowers in somewhat similar manner this season, but the flowering season being so much later than in the experiment of last year, the later thinned plants could not overcome the initial advantage of the early thinned ones.

The data obtained from the boll material collected from the 60 selected plants in each treatment can best be summarised in the manner set out in the accompanying table:—

Boll Data for Height of Thinning Experiment.

Total number of bolls per plant	Most on the earliest thinning; least on latest one. Differences not significant statistically.
Number of bolls per lb. of seed cotton	Differences irregular. Differences not significant statistically.
Harvested bolls expressed as per cent. of total crop per plant each treatment	6 to 8, 55·7 per cent. 10 to 12, 54 per cent. 14 to 16, 47·3 per cent.
Average weight seed cotton per plant	Most on the earliest; least on latest. Difference between— 6 to 8 and 10 to 12 treatment, not significant, $\frac{D}{E} = 1{\cdot}43$ 6 to 8 and 14 to 16 treatment, significant, $\frac{D}{E} = 4{\cdot}10$ 10 to 12 and 14 to 16 treatment, not significant, $\frac{D}{E} = 2{\cdot}47$
Difference in number of 5- and 4-locked bolls per plant harvested in each treatment	Treatment— 6 to 8—Slight tendency for more 5's, not significant. 10 to 12—Greater tendency for more 4's, $\frac{D}{E} = 2{\cdot}39$ 14 to 16—Significant tendency for more 4's, $\frac{D}{E} = 5{\cdot}0$
Difference in number of 5- and 4-locked green bolls per plant unharvested	Treatment— 6 to 8—Highly significant in favour of 4-locked, $\frac{D}{E} = 9{\cdot}26$, 27 per cent. 5-locked 10 to 12—Highly significant in favour of 4-locked, $\frac{D}{E} = 10{\cdot}7$, 22 per cent. 5-locked 14 to 16—Highly significant in favour of 4-locked, $\frac{D}{E} = 11{\cdot}0$, 25 per cent. 5-locked
Difference in average weight of 5- and 4-locked bolls per plant	Treatment— 6 to 8—Highly significant in favour of 5's, $\frac{D}{E} = 9{\cdot}43$, 4's, 83 per cent. as heavy 10 to 12—Very significant in favour of 5's, $\frac{D}{E} = 6{\cdot}95$, 4's, 83 per cent. as heavy 14 to 16—Highly significant in favour of 5's, $\frac{D}{E} = 9{\cdot}15$, 4's, 83 per cent. as heavy
Percentage of the average number of 5-locked bolls of the average total number of bolls per plant	Treatment— 6 to 8—26·9 per cent. 10 to 12—20·9 per cent. 14 to 16—20 per cent.

It would appear from the above data that, under the conditions in which the experiment was conducted, the earliest thinning gave these advantages:—A few more bolls per plant; a slightly larger percentage

matured by time of first frosts; slightly more seed cotton than in the 10 to 12 treatment, and significantly more than in the 14 to 16 inch thinning; a higher percentage of 5-locked bolls of the total number of bolls borne per plant; and a higher percentage of 5-locked bolls in the bolls harvested.

The results would indicate, therefore, that the heavier rate of flowering observed in the earlier thinnings during the first period of flower counting was apparently to the advantage of these thinnings, in that a better yield was obtained by the time of the first killing frosts. This advantage in yield can be explained by the fact that, not only was there a higher percentage of bolls matured, but also there was a greater percentage of 5-locked bolls in the crop harvested. As the 4-locked bolls weighed only 83 per cent. as much as the 5's, it can be seen that this would materially influence the yield.

The results are different in some respects to those obtained last season in a similar experiment. Then, the total number of harvested bolls per plant ascended in favour of the later thinnings. The number of 5-locked bolls per plant averaged about the same in each treatment, but there was a significant difference against the 6 to 8 height of thinning in the number of 4-locked bolls per plant between the 6 to 8 and 10 to 12 treatments (D over E = 3·85), and between the 6 to 8 and 14 to 16 treatments (D over E = 4·4), and just hardly a significant difference in favour of the 14 to 16 inch thinning as compared to the 10 to 12 treatment (D over E = 3·05). The percentage of 5-locked bolls of the total number of bolls harvested per plant in each treatment was somewhat of the same order as in this season, with the exception that the 10 to 12 treatment had a higher percentage than did the 6 to 8: the figures are 6 to 8 27·9 per cent., 10 to 12 30·4 per cent., and 14 to 16 25·8 per cent. There was not such a range between the treatments as was the case this season.

The results obtained from the experiment for the last two seasons would indicate that thinning when the plants are 6 to 8 inches in height is conducive to the early development of the fruiting branch structure. This allows of the earlier production of flowers, and gives this height of thinning an advantage over the other heights tried. In a late planted crop this is of decided value, as a larger number of bolls will be harvested if early frosts occur. Apparently, in a late planted crop, there is a higher percentage of 5-locked bolls developed in the earlier maturing bolls of the 6 to 8 inch thinning than in either of the other two treatments. As the weight of the 4-locked bolls in the late planted experiment of this season averaged around 83 per cent. of the weight of the 5-locked, and from 84 per cent. to 90 per cent. in early planted plots of the previous season, it would appear that this greater percentage of 5-locked bolls in the earlier formed bolls is of decided advantage, especially in a short season.

Insect Problems.

Insect pests affected the yields obtained on the Station this season more than has been the case in any previous crop. The outstanding one was the corn-ear worm which completely destroyed the top crop of squares on all the late-planted cotton. Other insects present and causing varying amounts of damage were thrips, pink boll-worm, rough boll-worm, and the sucking bugs.

THRIPS (*THRIPS TABACI* LINDEMAN).

This insect was present during the early stages of the plant growth, and caused serious loss of terminals in many of the November planted plots. It was also present in the December planted plots, but to a much lesser degree. As in previous seasons, the presence of this insect after November appears to be correlated with the amount of rainfall. Under good rainfall there is but light infection in December, but when the precipitation is scanty in this month damage may be done even on plants a foot or more high.

CUTWORMS (*EUXOA RADIANS* GUEN.).

Owing to the fact that there was no cotton planted on the Station in either September or October, it cannot be stated if cutworms were present during this past spring. No reports were received of serious damage in the immediate district where October planting was obtained, so it is not believed that this pest was present in sufficient numbers to be of economic importance.

CORN-EAR WORM (*HELIOTHIS OBSOLETA* FABR.).

The Station suffered from attacks by this pest, the worst of any year since it has been established. The explanation appears to lie purely in the fact that all of the plots were late planted. The experiences of previous seasons have all demonstrated that late-planted crops on the Station soils are liable to attacks from the corn-ear worm. The conditions during this past season have been eminently suitable for heavy occurrence of this pest, and the losses received were to be expected.

Each season supplies evidence that damage from corn-ear worms and late-planted crops on rich alluvial loamy soils are very closely correlated. Exceptions occur, of course, but generally speaking this is true. Late-planted crops on clay soils, however, appear to be fairly free from atttack to an amazing extent. The explanation appears to lie in the nature of the plant growth. On rich alluvial loams the late-sown plants make a rapid sappy vegetative growth if the climatic conditions are at all favourable. On clayey soils, crops planted at the same time and receiving similar rainfall usually make a much slower and tougher growth which apparently is not attractive to this insect.

The lucerne plot on the Station was again the source of an invasion from the corn-ear worm. On the 31st January a migration of grubs similar to that of last season crossed the 18-foot roadway into E. block. This followed a rapid drying off and wilting of the lucerne. Bran, paris green, and molasses bait was scattered down the road, and in the cotton rows at right-angles to the road the plants for a distance of a chain were hand-picked of all larvæ. The measures taken were entirely successful. The emergence of moths responsible for this brood commenced following the 2·55 points of rain on the 4th and 5th December.

PINK BOLL WORM (*PLATYEDRA GOSSYPIELLA* SAUNDERS).

The light yields caused by the late planting and heavy corn-ear worm attacks prevented an examination of any value from being made in the plot which is annually examined for pink boll-worm. It was thought advisable, however, to attempt to obtain some data regarding the presence of this insect this season. Accordingly, 200 bolls were examined in a plot in the same portion of the field and only one worm was found. This was not a comparable test to the one of the previous

season, so no significance can be attached to the result. An isolated progeny increase planting in the orchard plot on top of the hill was also examined. This plot was adjacent to soft vine scrub and lay in line between the location of the first cotton plot ever planted in the district, and the bulk of the Station plots. As it is thought that the site of the first crop might be the original source of infection for the district, it was considered the progeny plot might show results of interest.

The material used for this examination was off-type plants which had been pulled up in the breeding operations. Ninety plants were taken, which came from all parts of the plot, which was about one-third of an acre in area. A total of 1,798 ripe and 2,658 green bolls were examined on those plants and the following numbers of pests obtained:—Pink boll-worm, 90; rough boll-worm (*Earius huegeli*), 28; and Peach sometimes called Maize Grub (*Conogethes punctiferalis* Gn.), 21. The number of pink boll-worms does not mean that percentage of boll infestation, however, as several bolls contained 2 worms and three bolls 3 worms. Unfortunately, the records were not taken so as to give the actual percentage of attacked bolls. Of the ninety plants examined, twenty-five did not have a pink boll-worm.

The results obtained in this inspection made it appear desirable to examine a crop in some other portion of the district. Accordingly, a field in the centre of an alluvial flat and some 12 miles from the Station was examined. Unfortunately, it was late in the season and only the green bolls of the upper part of the plants were available. The material is therefore hardly comparable with that obtained in the Station plot. The procedure adopted here was to select scattered well-laden plants over the field, which covered approximately 10 acres. As in the orchard plot on the Station, every boll was taken off each selected plant and thoroughly examined. A total of 2,300 bolls were inspected in this manner and the following worms found:—Pink boll-worm, 45; rough boll-worm, 18; peach grub, none. Seventy-two plants were examined, and thirty-six did not have a pink boll-worm in the green bolls.

During the above-described examinations a factor was observed which may have a decided bearing on the control of the pink boll-worm. It was noticed that in a considerable number of the attacked bolls the shrivelled form of the pink boll-worm still remained. Often a small whitish cocoon was found adjacent to it. This led to a close examination of the live larvæ which were found, and one was obtained which had three eggs laid on the back around the head. These eggs were hatched out but unfortunately the larvæ went into cocoons before they were noticed. The cocoons appeared to be identical with those found in the attacked bolls. Through an accident the three cocoons were destroyed, so some of the cocoons found adjacent to the parasitised pink boll-worms were forwarded to the Chief Entomologist at Brisbane. He has kindly advised that what appears to be a species of *Apanteles* emerged from these cocoons.

It would appear, therefore, that the population of pink boll-worms is not a serious economic factor in the Callide Valley at present. The presence of so many in a small plot near the softwood scrub indicates, however, that very careful methods of cleaning up the cotton crop should be exercised at the end of each season. This clean-up should be performed as early as possible, as many of the larvæ were found in the old diseased bolls, and an early destruction of the plants would have killed most of them.

SUCKING BUGS.

The False Stainer (*Aulacosternum nigrorubrum* Dall.) was present in larger numbers throughout most of the season than has ever been the case in previous crops on the Station. In fact, it appeared to be in as large numbers during the latter part of the season as was *Dysdercus sidæ*. It may be possible, therefore, that it is responsible for some of the punctures which in the past have been laid to *Dysdercus* and *Tectacoris lineola*. The fact that it occurs in large numbers during the squaring season, when there are practically no bolls on the plants, may also indicate that it is responsible for some of the square shedding, or, possibly, the peculiar late loss of terminals which has been experienced in the last three seasons.

The Harlequin Bug (*Tectacoris lineola* F.) was not seen until the 3rd February. Shortly afterwards, small numbers of both sexes were seen and a few clusters of egg colonies were found. This insect was hardly noticeable during the rest of the season, and was in even fewer numbers than in the previous season.

The large and small Stainers (*Dysdercus sidæ* Montr. and *Oxycarænus luctuosus* Montr.) were present, but in light numbers.

FRUIT FLY IN JAVA—A CORRECTION

In an article entitled "The Banana Weevil Borer in Java, with Notes on other Crop Pests," published in the Agricultural Journal of December, 1928, it was stated that the Mediterranean Fruit Fly (*Ceratitis capitata*) attacked citrus in Java. Advice has now been received from Java that the Mediterranean Fruit Fly does not occur in that country, the species being responsible for attacks on citrus being *Dacus ferrugineus*, which is controlled by poison bait sprays. Apparently this regrettable error arose through a misunderstanding in discussing fruit fly infestation in Java.

QUEENSLAND SHOW DATES.

AUGUST.

Peak Hill (N.S.W.), 5-6.
National Association, 11-16.
Crow's Nest, 27-28.
Wynnum, 29-30.

SEPTEMBER.

Parkes (N.S.W.), 2-3.
Imbil, 3-4.
Malanda, 5-6.
Bogan Gate (N.S.W.), 10.
Gympie, 10-11.
Redcliffe, 12-13.
Beenleigh, 19-20.
Rocklea, 27.
Esk Campdraft, 26-27.
Kenilworth, 27.

OCTOBER.

Southport, 3-4.
Enoggera, 4.
Nerang, 10.

NEW ZEALAND FARMERS IN QUEENSLAND.

The idea of mutual visits of farmers to New Zealand and Australia has developed greatly in recent years, and the tour lately of a party of New Zealand producers through the south-eastern corner of this State suggested even greater expansion of that idea in the future.

The need of the farmers of the Commonwealth and Dominion is to meet one another more, and to get to know something of each other's problems and successes, as well as to realise that they are not so much competitors as fellow-workers.

Personal contact and social interchanges mean, too, the removal of many misunderstandings and misconceptions and altogether a better appreciation of the fact that if we work together we can increase the prosperity of each Dominion, and at the same time add to the wealth and security of the British Empire as a whole.—Editor.

WARWICK was the first halt in the recent tour of a comparatively small section of Southern Queensland by a party of New Zealand farmers, who had come to see for themselves something of the Commonwealth and its country life. With all its orchards bare of leaf under a grey winter sky, the fruitful Granite Belt was not looking its best when the visitors passed through. Sufficient was seen, however, to suggest a sure, though strenuously acquired, prosperity in Queensland's apple uplands. When they reached the gateway of the Darling Downs, that vast territory said by Sir John Russell, of Rothamsted, to be one of the most fertile tracts of black-soil lands in the world, they saw something of the country on which Queensland's title as the most richly endowed State of the Commonwealth is based.

A Queensland welcome awaited the visitors at Warwick. Recent rains had caused a curtailment of the tourists' programme, and road travel was limited to the environs of the wheat land centre. From points of vantage, miles and miles of farming lands divided into wide valleys by lightly wooded uplands and rimmed by mist-wrapped mountain ranges were spread before the visitors' view. It was a winter landscape, nowhere to be matched within the Commonwealth—a countryside green with growing crops giving promise of a bountiful harvest, and dotted with homesteads on the banks of willow-shaded streams.

Mr. Colin McIntosh, leader of the Delegation, speaking on behalf of his fellow farmers, said that Warwick and its beautiful surroundings had greatly impressed them. Their party consisted of active farmers, and the object was not only sight-seeing, but education by an exchange of ideas with Queensland farmers. They were here to find out our difficulties, and to try to work together in solving ours and their own problems.

"We compete with each other in various markets," said Mr. McIntosh, "but there is plenty of room for us all." It was a fact that a lot of New Zealand land carried a cow to the acre, and five to seven sheep. The secret was not so much good soil, but principally climate, regular rainfall, use of fertiliser, and humidity, which gave abnormal growth. He was astounded at Australia's low land values, wheat land here being about half the cost of that in New Zealand.

Visit to the Netherby Stud.

A visit was made to Mr. J. T. Scrymgeour's Netherby stud, on the Condamine River, close to Warwick. This stud was formed by Mr. Scrymgeour in 1922 with a nucleus of about half-a-dozen cows of pure Scotch blood. Netherby is a small compact freehold property of 305 acres of heavy arable black-soil land, fronting the Condamine River, and extending on to a lighter red-soil ridge, where the homestead stands. "Milton's Grandmaster" and "Heatherwick's Standard-bearer," together with about twenty-five head of aristocratically bred cows and ten choice heifers, form the herd. Practically all the females are from imported blood in the immediate crosses. A small but select stud of thoroughbred horses is also maintained on the property.

Mr. Scrymgeour is an outstanding figure amongst cattlemen of the Commonwealth. Though he is totally blind, as the result of a gunshot wound in the head

received while a member of the 2nd Light Horse Regiment during the great war, he is a very keen judge of cattle, possessing a wonderfully developed sense of touch, and is able to fault an animal where another, possessed of his full powers of sight, would overlook slight blemishes. He personally supervises and takes an active part in the working of the farm. Mr. Scrymgeour has few equals in his knowledge of Shorthorn pedigrees, and is a keen follower of the turf, particularly at Brisbane. With the aid of a wireless set he is fully informed of the winners each race day, and through the daily newspapers, which are read to him, he is kept well acquainted with the doings of the outer world. From the homestead at Netherby to the paddocks and cattle stalls an ingenious arrangement is installed for the guidance of Mr. Scrymgeour. It consists of overhead wires, running from the homestead to the various paddocks and stalls. A hollow metal cylinder is drawn across the wires by means of a length of rope, one end of which is attached to the cylinder, and the other end left hanging loose so that it may be grasped by the hand, and so guide a person when walking along. The business of the farm is conducted by him, and he types his own correspondence. Mrs. Scrymgeour, who is a very capable stock judge and a noted horsewoman, is his remarkably keen lieutenant.

At Toowoomba.

The rest of the day was enjoyed in a journey across the Downs to Toowoomba. The Mayor of Toowoomba and representatives of the Chamber of Commerce and primary industries travelled to Warwick to meet the tourists, and on the way back pointed out places of interest, and provided useful information pertaining to the district's primary products.

"I am greatly surprised at the extensive areas of wheat grown on the Downs and the absence of grassed areas," said Mr. Colin McIntosh, in the course of an interview with a press representative. He said it was the custom in New Zealand for farmers to plant, say, two crops of wheat, and then sow grass in order to give the land a rest. He was greatly impressed with the samples of Queensland wheat exhibited on the train, and was of the opinion that they would meet with great favour in New Zealand, as they were hard varieties,

For the first time in their lives the majority of the visitors viewed the Illawarra breed of cattle. Mr. McIntosh stated that it appeared to be quite a first-class dual purpose animal, and the Australian equivalent to the New Zealand milking Shorthorn. They were both suited to their own particular countries, and he did not think that any good purpose would be served by attempts to introduce the Illawarra into New Zealand.

Toowoomba Butter Factory.

Mr. C. Lynch, a member of the party interested in dairying, expressed delight at the up-to-date butter factory inspected at Toowoomba. It was beautifully clean and excellently managed, but he did not think that there was anything here to surpass the efficient machinery installed in New Zealand factories.

At Gatton.

The New Zealanders regarded their visit to the Queensland Agricultural High School and College on their way down from Toowoomba as one of their most interesting experiences since their arrival in this country. According to their leader, Mr. McIntosh, the visitors were greatly impressed with the useful and progressive work being performed there. Personally, he rather liked the idea of taking boys direct from the primary schools and allowing them to get their secondary education at the college. In New Zealand they found that boys who were sent to the city schools to complete their studies were loath to return to the land. They lost in some degree the agricultural bias essential to their livelihood.

AT SWIFT'S MEATWORKS

Among the many inspections made by the party of New Zealand farmers while visiting the eastern coast of Australia was that of the meatworks of Swift Australian Company Limited, Brisbane. The visitors were warmly welcomed by the Swift organisation, which spared no pains in explaining their entire system of operations, from the slaughtering of the various classes of live stock to the final preparation of the many edible and inedible products obtained.

At the termination of the inspection a hearty vote of thanks was accorded the members of the staff, and in response Mr. E. F. Sunners, manager of the company, stated that it was a great pleasure for the officials of the company to meet the visiting farmers, particularly when they evinced such a keen interest in the manner

in which the products of the land were handled through the secondary stage of production. That, of course, was a very important stage, and, wherever their plants were located, it was the policy of the Swift people to encourage a closer understanding between the producers of the raw material and themselves as manufacturers and distributors of the finished products. As they were probably all aware, the Swift distribution of meat and allied products is conducted on an international basis, and the Swift brand, and the high standard it stands for, is known world-wide. It would probably interest them to know that when the company began operations in Queensland, some sixteen years ago, it invested more than £1,000,000 in building modern works, and since then has purchased live stock to the value of about £15,000,000, and paid away in wages and supplies some £6,000,000. "We have at our disposal in the importing countries of the world a highly organised selling organisation, which can take good care of the products shipped to it from the various surplus producing countries where the company's slaughtering operations are conducted, and you, gentlemen," continued Mr. Sunners, "have seen for yourselves the efficient methods we employ in the preparation of our products and towards the elimination of waste."

Profits from Savings.

They recognised the principle that profits largely came by way of savings, and that low costs, together with high-quality goods and services, were the answer to practically all business problems. They were the means of getting the trade and holding it against all comers, and in the meat industry that condition could best be achieved through large-scale operations. They were perhaps aware, also, added Mr. Sunners, that there were important developments taking place which suggested that the future distribution of meat products would be by way of packaged goods, identifiable as to quality. So far as this country was concerned this method of distribution would possibly be in its best interests. To-day they shipped in the quarter or carcass and paid freight and charges on a good deal of bone and fat which had to be trimmed off before the meat was cut up for final distribution to the public. That material, if trimmed off at the works, could be put to valuable use in this country in the shape of animal foods and fertiliser, which would be badly needed in the production of the type of animals which the market now desires.

Market Requirements.

It was very important that producers should have full knowledge of the trend in market requirements, and that they should endeavour to accordingly change their production methods as might be necessary to meet that trend. It was a well-established fact that the present trend in meat consumption was very definitely towards meat from young, light-weight, well-finished animals. New Zealanders, particularly in regard to lamb, appear to be well informed in that direction, and they were practising those methods which enabled them to market the desired type, and that would enable them to continue doing so.

That was a safe position to be in, for this was an age when the consumer demand must be studied if the products of the land were to freely enter into the channels of trade, and quality counted to-day in all classes of products. This situation necessarily involved improved technique in all forms of primary production. In this State it would possibly involve a definite separation between the breeding and the finishing of live stock. They had an unlimited amount of suitable breeding country, but to-day they were lacking in the resources for fattening, which was the limiting factor to their production. In that direction, however, there were enormous possibilities for development within the reliable coastal regions, and he would say also that the future progress of primary production would depend more on the supply and proper use of fertiliser than on the supply and use of any other single resource, and live stock and larger acre yields were interlocking terms. The more the possibilities of that partnership were appreciated and developed, the more certainty would there be of producers earning profits, and the quicker would be the return to national prosperity.

AT BUNDABERG

Though Bundaberg was the most northerly point of their itinerary, the New Zealand farmers were able to form a favourable idea of the vitality of the Queensland sugar industry. At Nambour rain was pouring at the time of their stay. They saw something of the sugar as well as the fruit industry, but not enough to impress them with its importance. So it was not until they got to the

Bundaberg district that they were able to realise the vastness and value of sugar-growing in this State. It was unfortunate that they could not go further north where some mills had already commenced crushing. With that additional experience they would have been able to appreciate more the magnitude of the sugar industry and the general efficiency of its organisation. Notwithstanding excessively wet weather, they were able to follow the programme set out for them by the Bundaberg canegrowers, with the exception, unfortunately, of field operations. Mr. W. G. Gibson, of Bingera, had arranged cultural and other field demonstrations for their benefit, and which heavy rain prevented. The Sugar Experiment Station was missed for the same reason.

Fertile Cane Lands.

The New Zealanders expressed themselves astonished with the fertility of the cane lands around Bingera and in the Woongarra district, and commended strongly the evidences of sound farming practice on all sides. Their commendation was beyond the ordinary and polite conventions associated with such visits, for everyone of the party was a practical farmer bearing the marks of keen intelligence and hard toil. Earlier in their tour they had not hesitated to criticise cultural methods in other parts of the State, though often those criticisms were based obviously on an imperfect knowledge of Queensland conditions. The clean fields and green manuring crops flourishing alongside standing cane appealed to them particularly. When viewing the modern mill at Bingera with its massive machinery many of the visitors expressed amazement at the evidence of huge capital invested in the industry, while all were keenly interested in the milling processes as explained to them by members of the management, as well as the technical and engineering staffs.

A Heart to Heart Talk.

Local canegrowers were not slow in seizing the unusual opportunity of a heart to heart talk with farmers of the Dominion on some economical aspects of the industry. The visitors had already expressed their approval of the White Australia doctrine, and that formed the text of an appeal to them to consider the practicability of placing Queensland sugar on New Zealand dining tables. Though it was recognised that the Dominion requirements are supplied by Fiji, a British colony, it was suggested that when Fijian shipments fell short of New Zealand's needs, Queensland sugar should replace the Javan product.

In welcoming the visitors to Bingera, Mr. Gibson struck a strong note when he said that he hoped the day would not be far distant when New Zealand would be buying portion of Queensland's surplus yield instead of the black labour product from the islands. It would mean, if such an arrangement were made, that instead of having to export all the surplus over 13,000 miles, a big percentage would only have to cross the Tasman Sea. Queenslanders appreciated the fact that New Zealanders bought their sugar at a very much lower rate than the price ruling in this country. They import sugar from Fiji and occasionally from Java, and that sugar represented the produce of coloured labour. He urged a full measure of reciprocity between both Dominions. After emphasising the national aspect of the industry, and that concerned the Dominion as well as the Commonwealth, for the security of each was involved and the destiny of each must be commonly shared, Mr. Gibson added that as growers and millers they had established a high standard of efficiency, and applied science was making possible further developments.

Not a Spoonfed Industry.

The industry was not in any way spoonfed as had been suggested by certain interests in the South. In the Bingera area there were 410 suppliers, who, with their families, represented approximately 2,000 persons. In addition, Bingera employed 400 men. From those figures, applying to one Queensland mill, they could grasp the magnitude and importance of the industry. Mr. A. Bourke, their cane inspector, had covered 8,000 miles in the previous five months in the course of his work.

In the course of his reply on behalf of the New Zealanders Mr. C. McIntosh said that in the Bundaberg district they were seeing something entirely new to them. He, for one, was astounded at the quantity of machinery necessary for the production of sugar. On the White Australia policy he thought that was a matter on which the Commonwealth could be congratulated. The Federal authorities had taken the long view which would work out ultimately to the security of both Dominions. In New Zealand they had already a colour problem, for the fruit industry had passed into the control of Asiatics. He was especially impressed with

the fact that most of the machinery used in the Queensland sugar industry was manufactured in great foundries within the sugar belt; that showed that the industry was practically self-contained; it was also an example of the general progress which it made possible.

The value of these inter-dominion visits is strikingly obvious. Most of the New Zealanders were making their first journey away from the Dominion; they came with receptive minds and as shrewd observers they have gone away with a clearer idea of what the sugar industry means to Australia, and also, from the point of view of national security to New Zealand.

A Well Organised Tour.

The whole tour in Queensland was the last word in efficient organisation. Though the weather was excessively wet, especially on the near North Coast, there were no delays and no inconvenience. Mr. F. Pawson, representing the New Zealand Government, was the manager of the tour. The "Reso" train provided by the Queensland Railway Department was replete with every comfort. The Railway representative, Mr. A. E. Cole, proved himself an expert in modern transport. With the Railway Department was associated the Department of Agriculture and Stock, and two officers, Messrs. H. S. Hunter (Agricultural Branch) and J. F. F. Reid (Editor of Publications) accompanied the visitors throughout their tour.

The leader of the New Zealanders, Mr. Colin McIntosh, in the course of acknowledgments to the personal welcome his party had received from the Hon. Godfrey Morgan (Minister for Railways) and the Hon. Harry F. Walker (Minister for Agriculture), paid a tribute to the excellence of the arrangements made which enabled them to fulfil the purposes of an unforgettable visit to Queensland.

NERVOUS COWS AT MILKING TIME.

Milk secretion and milking is discussed by Mr. Stephen Bartlett, of the National Institute for Research in Dairying, in the Berkshire Milk-recording Society's Handbook. Some causes of variation in quantity and quality of milk are, he tells us:—

(1) Those causes which affect the speed at which milk is secreted or made in the udder between milking times.

(2) Those causes which tend to induce a cow to hold up a proportion of her milk at milking times.

Under the first heading it is known that secretion by many of the body glands is reduced by such things as insufficient food, ill-health or disease, fear, anger, and discomfort. Also there are other well-known factors which affect the speed of milk secretion, such as stage of lactation and age of the cow, as well as the point already mentioned, that secretion becomes slower as the quantity of milk in the udder increases.

Under the second heading one of the chief points to be noted is that the strippings of any cow are almost invariably rich in fat, sometimes being as rich as thin cream, so that retention of varying quantities of this rich milk will affect the quality of milk yielded by a cow more than it affects the quantity, and this can account for a considerable amount of the fluctuations which occur in the fat content of milk of cows from day to day.

It is possible that this holding up of portions of milk at milking time is associated with the differences in fat contents which occur between morning and evening's milk when unequal night's and day intervals occur, but since conclusive evidence cannot be offered, it is not desirable to emphasise the point. Since accumulated milk in the udder checks the rate of secretion, it will be obvious that milk retained at one milking will retard the rate of secretion before the next milking, and the effect of inefficient milking is to create a type of vicious circle which reduces milk yield.

If cows are always treated in such a manner that they never suffer any unnecessary discomfort nor have any reason to sense danger from their masters there is less chance of milk being held up at milking time. It is only reasonable to expect some cows to possess more uneven temperaments than others, and so one cow may be affected by a disturbance which another fails to notice. It has been found that milk secretion is not controlled by the nerves, for a cow can secrete milk when the nerves of the udder do not function, at the same time there is no doubt that during the actual milking process nervous control plays an important part, and unless a cow experiences a pleasurable sensation, free from fright, during milking time, it is unlikely that all the milk will be drawn.

QUEENSLAND BUTTER.

By CHAS. McGRATH, Supervisor of Dairying.

Subjoined is the text of an address delivered by Mr. McGrath at the Annual Conference of the Queensland Butter and Cheese Factory Managers and Secretaries' Association at Brisbane in June last. In the course of his address Mr. McGrath reviewed the position and the conditions of dairying in Queensland. He reminded his hearers that the pastoral, agricultural, and dairying industries represent the greatest actual and potential purchasing power in the Commonwealth. Through their efficient operation, they represent, too, the source of a strengthening current of finance that is vitalising the various groups of manufacturing and commercial activities.

FROM a perusal of the figures available it is learnt that the quality of butter produced for the year ending 30th June, 1930, will exceed that of the previous year, which was the peak year by some £2,000,000; the production of cheese will approximate that of last year, while the total value of the dairy products of the State for the year will be approximately £7,000,000 sterling.

The dairy herds of the State form the medium through which we recover this large amount of wealth by converting pasturage and fodder crops into milk. By such transmission the soil is not impoverished, but, on the contrary, by modern dairy methods it is left in a condition every year to continue to maintain or increase its productivity.

In this State and throughout the Commonwealth the return from grazing, dairying, and agricultural activities is the basis of our national wealth, and our future prosperity is directly associated with the conservation and improvement of our native pasturage, the maintenance of the soil fertility, the conservation of fodder, and the breeding of high class live stock.

The dairy industry is varied in its activities which include the milk supplies to cities and towns, the manufacture of butter, cheese, condensed milk, ice cream, and a variety of products obtained from casein.

There is evidence that in the near future the primary producers will give the matter of the city and town milk requirements more attention.

Food Value of Milk and Its Products.

As the comparative food values of milk and milk products become more widely known, these products will enter more largely into the daily dietary of the people than they do at present. The consumption of milk and butter is on the increase, but owing to the facilities offered residents of suburbs of cities and towns to keep a house cow, definite figures relative to the actual quantities of milk and butter produced from such sources are difficult to obtain. There are some hundreds of good type Jerseys, Australian Illawarra Shorthorns, and Ayrshires kept for household purposes by men engaged in activities other than dairying in cities and towns throughout the State.

The citizens of the State and Commonwealth are connoisseurs of dairy products, and only first grade dairy products are marketed in our own home markets.

The output of all the butter factories in this State is the product of pasteurised cream, and our choice butters have reached a high standard of quality.

As in dress so in dietary, the public taste undergoes a change as time wears on and the vast majority of the consumers now appreciate a sweet, mild, clean-flavoured appetising butter. The factory managements have responded to the demand and the market requirements are fully met by the output of the choice grade butter of factories throughout the State.

Oversea Market Requirements.

I availed myself of the opportunity of spending a forenoon on the grading floors with Mr. Pollard, a representative of the firm of H. Dean and Co., the well known firm of dairy produce merchants of London. From his selections of butter

it was evident that the market of the United Kingdom favours a sweet, clean, mild-flavoured butter possessing the characteristics of the butters that are placed in the premier position at the annual competition in Brisbane.

Butter possessing the desired characteristics is the product of clean, full-flavoured nearly-sweet cream, for from experience I know that the premier butter on the benches in this year's competition is the product of carefully selected cream possessing the characteristics mentioned, and have been made by skilled butter makers who have gained further honours for their companies and incidentally for the State.

The delivery of a high grade nearly-sweet cream is of vital importance to the industry and is dependent upon its production under hygenic conditions, with frequent deliveries to the factory.

Cream Transport.

The importance of organisation of transport from farm to factory will assist in improving the quality of the cream and make for increased efficiency in the conduct of factory operations.

Any dispute regarding the territorial rights of supply to factories should not be allowed to block the way to organisation of transport. Where disputes exist regarding the territory from which dairy factories should solicit supplies, the matter should be referred for settlement to a committee of three disinterested persons nominated by the chairman of directors of the dairy companies operating in the division of the State where the dispute exists.

Interstate Boundaries.

Through the activities of the State Boards associated with the industry, the interstate boundaries have been effaced as far as they pertain to the operations of the dairying industry, and the good will which now exists among dairymen throughout the Commonwealth ensures an improvement not only in their material, but also in their social welfare. The time for settlement of minor inter-factory differences or misunderstandings is overdue.

Quality of Butter.

Co-operation with the officers of the Commonwealth Grading Division enables State officers to examine and grade all the dairy produce submitted for export; and, in conjunction with the examination and grading of dairy products intended for interstate and local markets, affords the State officers an opportunity of forming a comprehensive and reliable opinion on the quality of the dairy products manufactured in the State. The system allows of a comparison being made of the quality from year to year, and of the influence of seasonal conditions on the products of the industry.

From a review of the reports by the Chief Grading Officer for Queensland, Mr. G. H. Heers, it is learnt that a general improvement has taken place in the quality of the butter and there is a greater degree of uniformity.

Manufacturing faults are infrequent, and this is due to the fact that the great majority of factories have installed modern efficient manufacturing plants. Generally the body, texture, and condition of the butter marketed is evidence of the efficiency of the men who are responsible for its manufacture.

During the summer, floods that occurred in sections of the dairying districts prevented regular deliveries of the cream, and this accounted largely for the quantity of inferior butter manufactured.

While there has been a general improvement in the quality of the butter produced during the year, I wish to stress the necessity of increased effort on the part of all associated with the industry, with a view of maintaining a high standard of quality and of using every endeavour to eliminate the production of low grade products.

A review of the work of the butter graders during the year indicates that the cream graders at some of the factories are passing into choice and first grades a proportion of cream that is not up to the standard quality of the cream with which it is pooled. "Border" cream" is a term applied in cream grading to

a product of doubtful character. The term implies that on a quality determination it is in the line of division between two grades, and the tendency is to class it with the higher of the grades.

A trained and experienced grader, by the exercise of care on the grading floor, and by keeping in touch with the results of his work as disclosed by an examination and grading of the butter produced from the graded cream, will be enabled to classify the cream according to its quality and do justice to all producers.

The cream grader is entrusted with most important duties, and on their proper performance depends to a very great extent the welfare of the factory and the producers associated with it. If cream be put into a pool with a product of a higher grade, the supplier of the higher grade product is deprived of a portion of the return to which he is entitled. By careful grading a premium is paid for quality, and it is only by paying a premium for high quality can we expect to obtain quality.

The quality of the butter is influenced to a great extent by the care and attention given to its production and handling on the farm, and the reputation of a factory's management and staff suffers in proportion to any inefficiency which may exist in the grading and manufacturing departments.

Modernly equipped dairy factories make provision for the handling and processing of the cream so as to ensure that the butter produced will be of the highest quality that can be obtained from the cream treated.

Pasteurisation.

Attention to detail and efficiency in carrying out the processing of the cream are essential in order to obtain the benefits of pasteurisation. The flash system is installed in practically all the factories of the State. The batch system serves a few factories of small output.

The importance of subjecting all portions of the cream to effective temperatures cannot be too strongly stressed, and provision should be made so that when desired the cream leaving the pasteuriser can be returned to the bulk cream tank and enable the processor to carry out his work efficiently. Should a portion of the cream pass from the pasteuriser to the cooler without being subjected to the required temperature, it would recontaminate the bulk cream in the holding vat. Other sources of recontamination of the pasteurised cream are unclean cream coolers, pipes, holding vats, churns, packers, and contaminated wash water. Provision should be made to facilitate the cleansing and sterilising of all portions of the plant and utensils with which the cream and butter comes in contact.

Surface Taint in Butter.

Realising the necessity of eliminating a surface defect in butter, which may be confused with a flavour taken up by the surface of butter which is in proximity to unseasoned timber, a committee consisting of Messrs. C. F. McGrath (Supervisor of Dairying), G. H. Heers (Senior Grader), J. C. Brünnich (Agricultural Chemist), E. C. Tommerup, B.Sc., C. J. J. Watson (Forestry Department), C. J. Pound (Government Bacteriologist), F. W. Uhlmann (General Manager, Caboolture Co-operative Dairy Association), and D. Saxelby (General Manager, Queensland Farmers' Co-operative Dairy Association), representatives of the Factory Managers' Association was appointed by the Minister for Agriculture, Mr. H. F. Walker, to ascertain the cause of the defect and suggest remedies for its elimination.

Exhaustive experiments were carried out with varieties of timber used in the construction of butter boxes within the Commonwealth. Two members of the committee, Messrs. Heers and Uhlmann, visited New South Wales and Victoria to ascertain if the defect were peculiar to the butter manufactured in this State. It was found that a defect of a similar character was existent in the product in both the Southern States. In carrying out their investigations, the co-operation of the State and Federal officers was readily forthcoming.

In testing the suitability of various timbers as butter containers, exhaustive tests were made and will be fully dealt with in a report to be furnished by the committee when further investigations which are now proceeding are completed. Results of the experiments, relative to the influence of the timber used in the construction of butter boxes on the incidence of the defect, justifies the committee in arriving at the conclusion that Queensland Hoop Pine and Kauri Pine are second to no other timber used in the experiments.

The following timbers were used experimentally:—Queensland Hoop Pine and Kauri Pine, New Zealand White Pine, Grey Satinash, and Silver Quandong.

Moisture Content in Butter.

The standardisation of the moisture content of the butter does not receive in a few cases the attention that its importance warrants, for several brands of butter vary considerably in moisture content. Determinations of the moisture should be made at intervals during the working of the butter and so ensure a content of approximately 15.75 per cent.

Deodorisation of Cream.

A decided improvement in the quality of butter was noticeable from those factories which had installed cream deodorisers. The process is found beneficial in removing volatile and volatilable feed odours and flavours and, by increasing efficiency of the process of pasteurisation, adds to the keeping properties of butter. It will not convert an old, stale, fermented cream into a first grade substance. The expense of so processing such low grade cream is not covered by any improvement in the quality of the product.

Improvement of Factory Buildings and Equipment.

At no previous period in the history of the dairying industry has the matter of improvement of dairy factory buildings and equipment received the amount of attention that has been given during the period under review.

Large factories constructed of concrete or brick and supplied with the most modern dairy factory equipment have been completed or are under construction in dairy centres in Southern and Central Queensland.

The opening of a modern butter factory at Toowoomba in May last was associated with conferences of the several Boards functioning under the provisions of the Primary Producers' Organisation and Marketing Acts. Official representatives of the industry from all the States of the Commonwealth attended to confer on matters of vital importance to all associated with the industry throughout Australia. Facilities were afforded the visitors to see a large area of the Downs, and one and all were greatly impressed with the fertility of the expansive Darling Downs Tableland. In their association with the opening of the Downs Co-operative Butter Factory at Toowoomba they voiced their admiration of the optimism of the directors of the company in establishing a large modern factory, and leaders of the industry from other States who recently toured the dairy centres overseas pronounced the new factory and equipment to be second to none in the dairy world. A large modern butter factory is nearing completion for the Port Curtis Co-operative Dairy Association at Gladstone, which on completion will be worthy of similar commendation.

The holding of the conference of the members of the Executive of Boards associated with the industry in centres of dairying activities is commended, for by so doing information is obtained that assists them in carrying out their important duties.

The Future.

It is significant that organised dairy farming is now recognised on the part of the Government and by commercial and industrial groups as a vital economic factor in the progress and prosperity of the Commonwealth. I say, advisedly, dairy farming conditions as they existed prior to the closer organisation of the industry were such as to deter the settlement of the rich agricultural areas of this State, which are now dotted with the homesteads of progressive agriculturists and dairy farmers.

Grazing, agriculture, and dairy farming represent the greatest potential purchasing power of the Commonwealth. The financial returns from such sources are made available for the further development of rural areas, and the improvement, construction, and equipment of manufacturing units, thereby creating a strengthening current of finance to vitalise the various groups of manufacturing and commercial activities.

The outstanding factor that inspires confidence in the future is the strength of the co-operative control ensuring recognition of a policy in the best interests of the industry, efficiently carried out by the various controlling boards.

Agricultural and dairying activities differ from some other groups in that the returns therefrom are largely invested in the products of various industrial activities which by increasing the volume of employment and thereby stimulating trade adds to the prosperity of the people as a whole.

PINEAPPLE CULTURE.

NOTES ON MANURIAL EXPERIMENTS.

The Director of Fruit Culture, Mr. George Williams, has supplied the following notes of some manurial trials carried out on the Pineapple Experimental Plot at Elimbah.

Area: Half acre. Soil: Light loam—grey to light brown. Treatment: Quarter area subsoiled with gelignite. Air slaked lime applied to ¼ acre, pulverised lime on ¼ acre in October, 1928.

Maize was planted for a green crop and ploughed under in February, 1929. The final ploughing prior to planting was from 9 in. to 12 in. deep. The plots were planted with gill sprouts at the end of March, 1929. Paper mulch was used in three rows. Fertilisers were applied to fourteen rows; two were untreated.

Inspection twelve months after planting shows a distinct advantage in favour of potash; in fact; the most promising row had been treated with potash sulphate only. Phosphates including bone dust showed no appreciable results. Dried blood improved the colour of the foliage and to some extent stimulated growth. When associated with potash the colour of the foliage was improved without appreciable increase in growth above that where potash alone was used. To the soil occupied by two rows, calcium cyanide was applied before planting with the object of destroying nematodes if present. The plants showed no benefit.

Three rows planted through paper mulch do not in this particular class of soil show any resultant benefit. The experiment is being continued, further applications of fertiliser having recently been made. It was noted before planting that a portion of the plot required draining, and this is now more reflected in the plant growth. Necessary drainage is now being considered and this practice will, it is expected, result in a marked improvement on next season's growth.

Detailed information is shown in the following table:—

Plot: Fourteen Double Rows—9 ft. (Centre to Centre) apart, 50 yards in Length.

Row Number.	Nauru Phosphate.	Sulphate Potash.	Dried Blood.	Bone Dust.	
	Lb.	Lb.	Lb.	Lb.	
1 ..	..	..	..	..	Check; poor growth.
2 ..	24	..	..	..	Soil treated with calcium cyanide; no improvement.
3 ..	24	..	..	..	Paper mulched; poor growth; pale foliage.
4 ..	..	..	20	..	Growth improved; of good colour.
5 ..	..	16	20	..	Growth fair; even; rather pale.
6 ..	..	..	..	40	Paper mulched; poor; pale growth.
7 ..	..	20	..	..	Good growth; fair colour; best row.
8 ..	18	..	18	..	Medium growth; good colour.
9 ..	16	18	14	..	Paper mulched; variable; fair to good.
10 ..	20	24	18	..	Fair growth and colour.
11 ..	..	24	18	40	Fair growth and colour.
12 ..	14	20	16	..	Paper mulched; soil treated with calcium cyanide; poor growth.
13 ..	12	..	..	30	Poor weak growth.
14 ..	..	..	..	..	Check: poor condition.

Rows 1 to 9 soil trenched with explosive.

Plate 51.—Row No. 3. Pines Planted through Paper Mulch.

Plate 52. A Field in Need of Drainage.

Plate 53.—Row No. 7. Row Treated with Potash (20 lb.) only.

Plate 54.—General View of Plot.

WINTER SCHOOL FOR PIG FARMERS.

By E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

Covering a fortnight's residence at the Queensland Agricultural College, at Gatton, and including both practical and theoretical training, the third of a series of schools of instruction for farmers, and their sons, interested in the breeding, feeding, and management of pigs, concluded early last month. Though the attendance was smaller at this than at former schools, the reduced number in no way indicated lack of interest, but was entirely due to abnormal weather conditions, heavy rain and, in some districts, floods a few days before the school opened, necessitating cancellation of arrangements by other farmers who had intended being present.

This year's school was marked by even keener interest and application, and the students as a body reported that they had thoroughly enjoyed and much appreciated the opportunity provided of attending such an important course of training. Mr. W. Koehler, of Yamsion, Dalby, who was elected president of the school committee, said that the school would have a vast influence in creating greater interest, leading to considerable improvement in the type of pigs bred and marketed in Queensland. His own experience in attending the lectures and practical demonstrations was that he had been enabled in the two weeks at the College to learn much more about pig farming than he had thought possible in such a comparatively short course. Professor J. K. Murray, B.A., N.D.D., Principal of the College and Professor of the Chair of Agriculture at the Queensland University, addressed the students on several occasions and gave a most interesting series of talks on "Bacteriology and the use of the Microscope," and also on the "Principles of Feeding, Balancing of Rations." The value of these schools of intensive instruction is highly appraised by the Principal, and already several other important schools have been held including Tractor Schools, and Dairy Factory Employees' Schools.

Mr. A. J. Mackenzie, Lecturer in Animal Husbandry, was present throughout and gave a number of valuable lectures on Diseases of the Pig, on Improvement of Breeds, and on Anatomy, Physiology, and other phases of animal husbandry.

Mr. E. J. Shelton, H.D.A., Senior Instructor in Pig Raising, and Mr. L. A. Downey, H.D.A., Instructor in Pig Raising, were also present and dealt both in lectures and practical demonstrations with the subjects of Breeds of Pigs, Housing and Accommodation, Design and Construction of Piggeries, the Selection and Judging of Breeding Stock. These lectures were also illustrated by lantern slides. The evening sessions were also attended by the regular College students.

Mr. J. F. F. Reid, Editor of Publications, Department of Agriculture and Stock, discussed, in an informative way, ways and means of "Putting More Money into the Farmer's Pocket." The students would have liked Mr. Reid to have enlarged on this subject and on economics generally, but time did not permit. The "Parasites of Livestock" were discussed and illustrated by Mr. F. H. S. Roberts, M.Sc., recently appointed Veterinary Parasitologist in the Agricultural Department; while Mr. C. T. White, Government Botanist, dealt very fully, in a practical demonstration, with the question of Poisonous Plants and Weeds. To indicate ways and means of keeping piggeries in a more hygienic condition and in a manner that will be satisfactory to Departmental Inspectors, Mr. H. G. Cheeseman, Senior Slaughtering Inspector, attended and spent a very useful hour with the class. Mr. C. J. Pound, Government Bacteriologist, dealt very fully, both in a practical talk and in an illustrated lecture, with Tuberculosis in Pigs and Other Stock, and with the use of Disinfectants. These lectures are always of interest and value, and have an important bearing on the management of farm stock.

By means of a cinematograph film and in an informative talk, Mr. R. G. Watson, Chairman of the Queensland Pig Industry Committee, and Secretary of the Queensland Bacon Curers' Association, dealt with Commercial Pig Farming, and indicated the procedure on his own pig farms at Kingston and Beaudesert, where more than 800 pigs are kept and fed on buttermilk and farm-grown foods, with commercial foods purchased from outside sources. Mr Watson, in his capacity as President of the Australian Stud Pig Breeders' Society, also briefly reviewed the activities of that body and of the Queensland Branch which now has more than 100 members.

Mr. A. G. Aitchison discussed the Home Project Schemes in which the Departments of Agriculture and Stock and of Public Instruction are co-operatively interested, and illustrated boys and girls at work in country Pig and Calf Clubs, Poultry Clubs, and other activities of special interest to the junior farmer.

Mr. Woodward, of the College staff, dealt with Farm Bookkeeping, and Mr. Graham with Fodder Crops, Soils, and Agricultural Machinery. Mr. Bosworth, of the staff, also discussed Agricultural Education and the Growth of Co-operative Societies. The practical demonstrations included lessons on castration, killing and dressing porkers, and post mortem work generally. Some time was spent in inspection of the stock, and discussion on the Pig Breeding Experiments at the College

PLATE 55.

Members of the School of Instruction for Pig Farming held at Gatton College, Queensland, July, 1930.

Piggery, where between 500 and 600 pigs are kept. For the information of all concerned Mr. J. P. Bottomley, Treasurer, and Mr. H. W. Watson, Secretary of the Royal National Agricultural Association, Brisbane, reviewed the activities of that organisation and discussed the Pig Section Classes at the Brisbane Exhibition, Queensland's great livestock show.

In the course of the sessions of the school, the members of the Queensland Pig Industry Committee attended to hold their monthly meeting, and inspect the stock in the Pig Breeding Experiments in which they also are interested. On this occasion opportunity was taken by the members to discuss with the school questions relating to the marketing of pigs and to the urgency of increasing local consumption of Queensland pork products.

An hour was spent each evening in asking and answering questions and in general discussion of various topics, while the weekly picture show and a breaking-up social concluded a very interesting course of instruction to which a much larger attendance is expected next year.

Those attending the course included:—L. Caulley, Sexton, via Miva; D. J. Gillespie, Wynnum South; H. Fox, Cushnie, Tingoora; J. S. Wengert, Cushnie, Tingoora; W. Koehler, Yamsion Stud Piggery, Yamsion; S. G. Knight, Ballgamon, Nanango; Len Storey, Kingsthorpe; H. Mansbridge, Greenmount; J. S. Porter, "Gallangowan," Nanango; H. B. Taylor, Monal Creek; P. Kajewski, Glencoe, Gowrie Junction; M. J. Brosnan, Headington Hill, Clifton; A. Kerle, Rosevale, Kalbar; and F. Wright, Rosewood.

In addition, three special course college students and three University students attended certain of the lectures and demonstrations and were present on the occasion of the visit to the bacon factories.

IMPORTED PEDIGREE SOWS.

There arrived during the week ending 6th July, 1930, from New Zealand, two Large White sows from the stud of Mr. C. S. Mexted, Te Kawa. One sow is for Mr. R. G. Watson, of the Kingston Pig Farm Company, and the other is for Mr. J. A. Heading, of Murgon. These two sows are full sisters. One sow took first prize at the Hamilton and Otorohanga Shows and the second at Auckland, while the other won second prize at the first two shows and first prize at Auckland. They are by Tamaki Canadian Sargeant (the North Island Champion boar) from the famous sow College Y 745 (imported from Canada). This sow won with outstanding honours in Canada and since going to New Zealand has been shown three times, gaining three firsts and two championships. The sows imported to Queensland are in pig to Tamaki Major. This importation introduces to Queensland some of the best blood of the Large White breed obtainable in the Southern Hemisphere and, as the breed has been recommended by all countries that have conducted inquiries into the pig industry, these sows, together with introductions by the same stud masters from Victoria, should be a decided acquisition to the stud pig industry of Queensland.

IN FAVOUR OF THE LARGE WHITE PIG.

Writing in support of the Large White pig (also called the Large Yorkshire and the Large White Yorkshire), a prominent Southern breeder states this breed has made rapid headway in Victoria.

Seven years ago there were only two studs of the breed in that State, whereas to-day many of the leading breeders are turning their eyes towards this famous old British breed, and there are numerous very high-class studs from which suitable stock could be secured. By many they are considered the best bacon-producing pigs in the State, and not only the best but the most economical producers of high-quality bacon. They are very early-maturing, and are ideal as baconers on account of their long, deep sides which do not carry too much fat, as many other types do, and which on that account in other countries are often referred to as "lard" breeds. The texture of the Large White bacon is fine and, being early-maturing, it is more succulent and palatable than the slower-maturing types, and also more suitable for Australian requirements. The Large Whites are splendid pigs for crossing purposes, and in that respect have been the means of greatly improving many common herds of pigs from a bacon-curer's standpoint. They are readily sought, and invariably bring the highest prices at pig sales. Baconers have been sold for the farm of the breeder referred to at the age of eighteen weeks, whereas twenty-two weeks had been the best for any other type weighing 130-140 lb. These records have often been exceeded overseas, where also the breed is extremely popular.

CLIMATOLOGICAL TABLE—JUNE, 1930.

Supplied by the Commonwealth of Australia Meteorological Bureau, Brisbane.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·99	79	64	85	1	54	29	340	3
Herberton	..	70	50	76	16	34	20,21	57	5
Rockhampton	30·07	71	55	77	7	45	5	1,047	13
Brisbane	30·13	68	54	74	1	41	9	758	16
Darling Downs.									
Dalby	30·15	64	47	72	22	28	9	236	10
Stanthorpe	..	57	43	65	20	19	9	470	19
Toowoomba	..	58	46	65	21	31	9,30	831	17
Mid-interior.									
Georgetown	29·99	80	51	86	9	36	18	5	1
Longreach	30·10	70	48	79	29	41	17	15	3
Mitchell	30·15	62	44	70	23	28	10	184	14
Western.									
Burketown	30·03	80	56	85	10,27	49	18,19	0	0
Boulia	30·11	74	46	80	26,28	38	21	0	0
Thargomindah	30·16	63	47	71	26,27	37	9	30	3

RAINFALL IN THE AGRICULTURAL DISTRICTS.

Table showing the Average Rainfall for the Month of June, in the Agricultural Districts, together with Total Rainfall during June, 1930 and 1929, for Comparison.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	June.	No. of Years' Records.	June, 1930.	June, 1929.		June.	No. of Years' Records.	June, 1930.	June, 1929.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	1·61	29	1·14	1·29	Nambour	3·62	34	18·54	3·08
Cairns	2·78	48	3·40	2 60	Nanango	2·06	48	5·07	1·38
Cardwell	2·04	58	0·70	1·46	Rockhampton ..	2·38	43	10·47	10·39
Cooktown	2·00	54	4·00	2·02	Woodford	2·87	43	14·56	3·52
Herberton	1·04	43	0·57	0·87					
Ingham	2·34	38	2·92	1·60					
Innisfail	7·04	49	11·26	4·09					
Mossman	2·03	17	2·29	1·76	*Darling Downs.*				
Townsville	1·32	59	1·37	2·03	Dalby	1·70	60	2·36	1·15
					Emu Vale	1·53	34	3·75	2·73
Central Coast.					Jimbour	1·73	42	2·18	1·41
					Miles	1·83	45	2·24	0·75
Ayr	1·45	43	1·71	3·24	Stanthorpe	1·92	57	4·70	1·65
Bowen	1·61	59	3·28	1·81	Toowoomba ..	2·42	58	8·31	1·38
Charters Towers ..	1·30	48	1·86	1·76	Warwick	1·78	65	3·23	1·91
Mackay	2·68	59	3·07	2·41					
Proserpine	3·37	27	6·57	2·49					
St. Lawrence.. ..	2·49	59	7·77	6·87	*Maranoa.*				
					Roma	1·64	56	1·28	0·61
South Coast.									
Biggenden	2·17	31	7·01	1·97					
Bundaberg	2·84	47	8·76	3·36	*State Farms, &c.*				
Brisbane	2·85	79	7·58	4·40					
Caboolture	2·66	43	12·37	3·45	Bungeworgorai ..	1·48	16	1·34	0·43
Childers	2·48	35	8·70	1·38	Gatton College ..	1·87	31	5·93	1·47
Crohamhurst ..	4·44	37	21·36	4·66	Gindie	1·52	31	1·61	2·91
Esk	2·23	43	9·95	3·05	Hermitage	1·90	24	2·84	1·78
Gayndah	1·85	59	4·04	1·07	Kairi	1·46	16	0·86	1·42
Gympie	2·67	60	10·69	2·63	Mackay Sugar Experiment Station ..	2·38	33	3·38	2 54
Kilkivan	2·14	51	5·63	0·97	Warren	2·56	15	..	6 28
Maryborough ..	3·00	58	11·37	2·55					

GEORGE G. BOND, Divisional Meteorologist.

CONTAGIOUS ABORTION.

By J. A. RUDD, L.V.Sc., Veterinary Surgeon, Department of Agriculture and Stock.

THE special treatment of dairy cows for abortion depends largely as to whether it is (i.) Contagious abortion (*a*) Curable, (*b*) Incurable; (ii.) Sporadic abortion; or (iii.) Troubles after calving.

(*a*) Contagious abortion may be curable if it is due to the bacillus coli, provided certain very definite steps are taken to prevent its spread, such as isolation of aborting cattle for at least three weeks and the flooding of the uterus with permanganate of potash, 20 grains to each gallon of sterile water.

If the placenta or cleanings are not voided, the following drench will assist in causing expulsion of the placenta:—

Epsom salts	12 oz.
Carbonate of ammonia	1 oz.
Powdered gentian	1 oz.
Powdered ginger	1 oz.
Treacle	1 lb.
Water	1 gal.

After the lapse of twenty-four hours, syringe out or flood the uterus by gravitation with the above solution if the placenta has been voided, if not repeat the drench. This is very seldom necessary.

(*b*) Contagious abortion due to the bacillus abortus is incurable and is very serious indeed. Adopt the foregoing treatment and, in addition, isolate the cow for six weeks after calving or after she has aborted, and dispose of the foetus and placenta by fire if possible. The discharge from the uterus is highly contagious and generally persists for about four weeks after calving.

The proper method is to differentiate from the first by means of a blood test, and if the test is positive the best plan is to spey the cow and fatten her for the butcher.

How Infection is Spread.

The method of infection is chiefly through the mouth, and the predilection seat is the uterus if the cow is in calf, and if not the mammary gland where it remains until the cow becomes pregnant and then it enters the uterus. Cow licking a cow which has aborted. The exudate from the septic uterus draining down the thighs and tail becomes spread about the body through the agency of the tail, and it may even reach the bodies of other cows in this way. The bull may also carry the organism and infect a cow during copulation, and when the cow aborts the bacillus gravitates to the mammary gland. The placenta and foetus is capable of infecting a cow after it has laid out in the paddock exposed to climatic changes for some months, even up to eighteen months as proven by experimental evidence.

The Blood Test.

The blood test for contagious abortion can be carried out at the Yeerongpilly Stock Experimental Station, where information as to drawing the blood for the test may be obtained.

Seriousness of the Disease.

Contagious abortion caused by infection with the bacillus abortus is very serious because it is directly responsible for—

(i.) Ninety per cent. of all the in contact or infected cows of a herd aborting.

(ii.) Thirty per cent. of sterility among the aborting cows of the same herd.

(iii.) Possibility of a large percentage of cows not holding to the bull at first service.

(iv.) Sterility among bulls in the affected herd.

(v.) Losses from white scour of 70 per cent. of calves born of recently infected parents which carry a relative immunity to the disease. Calves from these infected parents are frequently born with white scour.

(vi.) Septic pneumonia of calves born of infected parents which carry a relative immunity which is practically incurable.

(vii.) Infection from these calves is very liable to spread to healthy calves born of parents which are free of this disease.

(i.) The statement that 90 per cent. of the cows abort when a herd is infected with the Bacillus Abortus of Bange may probably be considered high, but it is fairly constant if the abortions which prevail in the herd during the first two years after the first cow is a proven aborter is taken into consideration.

(ii.) *Thirty per cent. sterility among aborting cows.*—It is during the first three years after the first cow has been proven a contagious aborter in a herd that this second trouble arises, but unfortunately it does not end there. Even with the greatest care in after treatment, which is more than the average farmer can possibly spare the necessary time to carry out, it gradually extends to the best producers in the herd, and this for no apparent reason. There will be found, too, some cows in the herd which have never been known to abort, but for some unknown cause they will not prove in calf.

(iii.) The possibility of a large percentage of cows not holding to the bull at first service, but coming back repeatedly even when a fresh bull has been introduced into the herd, is always present. This may easily prove disastrous in a pure herd, for all blood lines of a particular strain may thus easily be lost for ever and the ultimate objective of the breeder shattered almost to despair.

(iv.) *Sterility among stud bulls in the affected herd.*—It has been repeatedly stated that the bull is not a carrier, even if infected by the Bacillus Abortus of Bange. If such is true, how then is it possible to find nests of this same bacillus abortus in the epididimi of the testicles of infected bulls, which readily react to a blood test for the bacillus abortus, and how is it that such a bull can, if he is not badly infected at the time of mating, serve and stint clean cows which are not infected and which abort four months after being stinted, not having up to that time been in contact with any infected cattle? This is fairly clear proof that a bull can carry the bacillus abortus and spread the disease. Therefore, the wandering bull which is to be found in all the dairying districts of this State should not be tolerated. How often does a careful dairy farmer find his own bull secure in his bull paddock and his neighbour's bull following his herd into his yard, and perhaps his best stud cow in calf to a useless bull of doubtful pedigree?

(v.) *White scour among calves born full time of parents which have a relative immunity to contagious abortion.*—This is fairly constant among such calves, and I have known cases which were affected with white scour at the time of birth. This disease in these calves is not only hard to cure, but when they are cured they do not prove to be regular breeders when mature. At best they are only fitful breeders and are more often running in the paddock half fat than producing at the pail. When they are milking and come into oestrum and mated to a proven bull they do not come on again, but give the impression that they have been stinted and at the lapse of nine months, when they should be calving and coming into profit, they upset calculations by coming in to oestrum again being served and perhaps stinted for the second time in eighteen months. Others again come on regularly every twenty-one days as heifers, and never seem to hold to the bull and remain to be ultimately fattened for the butcher.

(vi.) Septic pneumonia of calves born of parents carrying a relative immunity to the contagious abortion bacillus is not very common, but once it makes a start it runs through a herd of calves, whether they are the offspring of contagious aborters or not. It makes a clean sweep, and unless vigorous measures are practised the whole crop of calves for that particular season is wiped out. Therefore, it is not advisable to purchase calves indiscriminately or introduce them into a healthy herd of calves from outside sources in case they carry infection into the herd.

Sterility among dairy cows which have never aborted and are not positive to the test for contagious abortion may be due to the abovementioned causes, although there is no known means of ascertaining the truth. But if it is possible to trace back their ancestry, it will be found that contagious abortion due to bacillus abortion is responsible for their sterility, either partially or wholly, as it affects them to a greater or lesser extent.

INTRODUCTION OF THE STUD BULL.

No fresh bull or cow should be introduced into a clean herd without going through the blood test for contagious abortion. It is possible to do this without the assistance of a qualified veterinary surgeon by getting into touch with the Yeerongpilly Stock Experimental Station, or either of the Commonwealth Government Laboratories at Rockhampton or Toowoomba at a very small cost. The introduction of a fresh bull should not be seriously considered without the test for tuberculosis, and the cost of the services of a qualified veterinary surgeon should be the first cost on the price of the bull.

not advisable to purchase calves indiscriminately or introduce them into a healthy herd

Not long since, a bull on the North Coast was responsible for the introduction of contagious abortion into a clean herd of cattle, and all the trouble would have been saved if a blood test had been carried out before the bull was introduced into the herd.

Immunity and Relative Immunity.

Immunity means that an animal once it is infected with a disease and recovers never has a recurrence of the same disease, but is immune to this disease for the rest of its life.

Relative immunity means that an animal, once it is infected with a disease and recovers from the disease, may during its lifetime have a recurrence of the same disease, i.e., it is not a lasting immunity. With contagious abortion the animal carries a relative immunity and, in addition, remains a carrier of the disease during its lifetime and may have a recurrence of the disease in a virulent form.

SPORADIC ABORTION.

Sporadic abortion is not contagious and may be due to accidents which cannot well be avoided. Lack of phosphates in the soil, and feeding on mouldy fodder may be cited as some of many causes.

The treatment already given will answer the purpose and bring the cow back to health and in due time she will recover her normal state.

TROUBLES AFTER CALVING.

Ninety per cent. of the post-calving troubles are due to neglect of simple precautions, and the crude methods involved in dealing with the calves. The calves should be allowed to run at least for two days with their dams, as the sucking action of the calf assists in the contraction of the uterus or calf bed, and the rapid expulsion of the contents of the uterus and the return to normal of this important organ of reproduction assists the general health of the animal concerned, and gives her an opportunity to render useful service at the bucket. The calf should be at least easily accessible to the cow for the first six weeks after calving. So long as she can see her offspring she appears satisfied and content, but the call of the hungry calf which is very distressing does at all times upset the mother. There are some cows, and not always the best, that take little notice of their offspring, being more concerned with their own petty troubles. The cow which should be encouraged is one which makes it a practice of making the care and well-being of her calf a matter of constant concern, for the maternal instinct is strongly developed and, proportionately, her ability to do well at the bucket and conceive regularly at certain given intervals is greatly increased. At least for the first seven days after calving a good mother is always within earshot of her calf, and she should be allowed this as it is her natural right. If a cow has calves normally and there is little or no discharge, it is a grave mistake to interfere with her at all in the way of flooding the uterus and, except for cleansing of her tail and brush and back of the udder and perhaps the udder itself with good soap and water as soon as the calf is taken away, she should be left severely alone.

The clipping of all hair in and around the udder as far forward as the navel should be practised as a routine work on every dairy farm, for the long hairs collect the filth and predispose the large, well-developed udder to mastitis which is usually contagious.

Flooding of the uterus with blood due to hæmorrhage may take place nine days after calving, and although this is not a constant symptom it does occur and, provided it is not excessive, it could well be left alone. The calf should be fed, if possible, on mother's milk for at least three weeks before being placed on the mixed milk ration.

Septic Pneumonia Among Cows.

Septic pneumonia among aborting cows or cows which have a relative immunity to contagious abortion and have recently come into profit, or are in contact with contagious aborters is fairly common, especially among the best heavy producing cows, and frequently the response to treatment is not all that can be desired, and consequently the percentage of deaths among these cows is fairly high. On the outset of septic pneumonia the affected cows should be isolated and treated away from the main herd, and prompt action is necessary if satisfactory results are to be assured. The cows should be placed under cover, well bedded down, have easy access to ample clean water in the stall, and the services of a qualified veterinarian obtained and steps taken to bring about rapid recovery, for if the case hangs fire the profit for the year is completely lost even if the cow survives.

THE CARE OF THE CAR.

The Magneto and the Spark.

It is not unusual to hear a motorist boast that he has run 10,000 miles or more and never looked at a spark plug or had to touch his ignition system in any way.

The motorist who remembers the ignition systems of a few years ago marvels at the reliability of modern ignition systems, no matter whether they be magneto or battery and coil systems. The history of the development of the ignition system used on modern cars is of little practical value to the modern motorist, but is of interest.

The motor engines made in the last few years of last century were weird and wonderful arrangements, yet they were essentially the same as modern engines with the exception of the ignition and carburettion systems.

The "Hot Tube."

Thirty years ago very little was known of electricity and on the engines of those days various sorts of ignition devices were used. A somewhat successful type was the hot-tube ignition. This system consisted of a small tube fitted into the cylinder head. The tube was heated by an external lamp until the interior of the tube was red hot. The tube was isolated from the engine by means of a small valve, but when the mixture was compressed the valve opened and allowed the inflammable gas into the hot tube where it immediately ignited and the flame immediately blew back into the main combustion chamber and so ignited the whole of the mixture. Once the engine was started the burning of the gases inside the tube practically kept the tube hot without the use of the external blow lamp.

In order to withstand the heat at which the tubes were worked, they were made of platinum. In those days platinum had very few uses and was comparatively cheap. An engine fitted with such tubes to-day, when platinum is many times the price of gold, would need to be locked in a strong box.

Low-Tension Ignition.

About the same time as the hot-tube ignition was used the low-tension electrical system came into use. This system is still found in certain old stationary engines. A low voltage battery was used and a make-and-break was actually placed within the cylinder head. This make-and-break was so arranged that just when the ignition of the gases was required the circuit was opened and the resulting spark caused the gases to be ignited. The make-and-break was driven with a lever from the camshaft in much the same way as the valves are operated. The chief difficulty with this device was that the spindle that operated the make-and-break, together with the insulated connections, had to be kept gas-tight. Also the make-and-break was subjected to the terrific heat of the burning gases, and since it was situated within the cylinder head was not at all accessible for either cleaning or adjustment.

Originally the current for this ignition device was supplied by a battery of cells. These cells were not the same as those found in the modern battery, but were much more elaborate affairs so that the car really carried a small laboratory.

Later a magneto which generated a low-voltage current was developed and this magneto was known as a "low-tension" magneto as distinct from the modern "high-tension" magnetos. These low-tension magnetos were quite large affairs with several large permanent magnets.

Following on the low-tension system high-tension ignition systems were developed.

The essential difference between low-tension and high-tension ignition systems is that in the former the two pieces of metal causing the spark (electrodes) actually touched together and were then drawn apart so that a spark or arc resulted, while in the later such a high voltage is used that a spark will actually jump between two points separated by a sixteenth of an inch or more.

An example of the difference in the voltage required to do these two things is the following:—Every motorist has at some time or other accidentally caused a "short" on the battery of his car and has noticed that quite a violent spark results, as the "short" is removed, although the battery of the car has only six or twelve volts. On the other hand, a voltage in the neighbourhood of 10,000 volts is required to jump across the points of the average spark plug. High-tension ignition systems were first used with a make-and-break and spark coil in much the same manner as the modern coil ignition system. However, in the early days batteries were very

unreliable and generators to keep the battery charged were not available, so that the whole ignition system was unreliable. Thus when the high-tension magneto was developed it became very popular, as it was a self contained unit which generated all the electricity it required within itself.

Just prior to the war magneto ignition was almost universal on good quality cars, and the magneto had reached a high degree of perfection. The Bosch factory of Germany practically dominated the market, as the firm was the first to develop a satisfactory high-tension magneto. This same firm to day is well to the fore in the development of fuel injectors for high-speed Diesel engines, which bid fair to be the engines of the future.

The necessity for electric light and electric starting on the modern car has caused the electrical generator and battery to be brought to a high standard of reliability, and as a result battery ignition systems using an induction coil to convert the low voltage of the battery to high voltage (high tension) are once more the prevailing favourites, although twenty years ago the magneto had practically eliminated this system.—Radiator in "The Farmer and Settler."

THE FARM TRACTOR.

THE IMPORTANCE OF DECARBONISING

Probably the most common cause of trouble in the internal combustion motor is the formation of carbon on piston, cylinder, or valve heads, and at the end of a strenuous season a half-day may be profitably spent taking down the engine and decarbonising. This formation of carbon occurs in any internal combustion engine and is, more or less, governed by the extent to which the motor is used.

Obviously, the quality of the fuel and oil also plays an important part; but even with fuels and oils of the highest quality, carbon formation inside the motor is inevitable. The removal of this is a simple matter and should be regularly attended to, as carbon causes a variety of different troubles in the engine.

It is easy to see that a heavy formation of carbon on the piston and cylinder head reduces the compression space and correspondingly increases the compression ratio of the engine. If it is the manufacturer's idea that the compression ratio should be, say, 5 to 1, a heavy formation of carbon in the combustion chamber may increase this ratio sufficiently to cause a bad knocking, due to the heightened compression of the engine. This reduces the power of the motor, and the knocking considerably increases the wear on the working parts.

Carbon, too, is often responsible for pre-ignition. Pre-ignition means the igniting of the charge before the piston has reached the top dead centre of its stroke. The result is that the explosion occurs before it should, and the piston is met whilst still on its upward stroke with the force of the explosion causing bad knocking and undue wear.

The removal of carbon from any internal combustion engine is a simple matter, and can easily be accomplished by the tractor owner himself. The following method applies in the big majority of cases:—

First drain the radiator of water and loosen off the water connection between the radiator and the cylinder head. Remove the cylinder head bolts or nuts and carefully lift the head off, taking care not to damage the copper asbestos gasket which is between the head and the cylinder block. If this has become bent or torn in the process, it is wise to replace it with a new gasket, as no amount of straightening out or pressure will stop water from the radiator or explosive gases from seeping through the gasket, the copper lining of which has become creased. All the carbon on the cylinder head should be scraped off and the surface wiped clean with a kerosene rag. When scraping the tops of the pistons, bring each piston to the topmost point in the cylinder so that no carbon will adhere to the oil on the cylinder walls. Clean out the valve heads and ports, and see that no carbon lies between the valve and its seat. This would result in an imperfect seat and bad compression.

When the job is thoroughly clean, paint both sides of the copper asbestos gasket with shellac or gasket cement and replace the cylinder head. In tightening up the bolts, take them all up gradually so that the pressure is evenly distributed over the head. This is in order to avoid warping. Replace the water connection; refill

the radiator; and start the motor up. When it has run sufficiently to become warm, tighten up the cylinder head bolts again, as it will be found that, due to the vibration of the explosions and the expansion due to heat, the bolts can be still further tightened.

Decarbonising is an excellent job for the tractor owner on a rainy half day, and he will be amply repaid for his trouble. Obviously, the amount of carbon formed in an engine is, to a great extent, controlled by the quality of the kerosene and lubricating oil used in it.

Spark Plugs.

If an engine is giving uneven results, or is missing badly, the owner almost invariably attributes the trouble to the plugs and takes them out for inspection. This inspection, however, generally does not go much farther than the points of the plugs which, as a general rule, are not responsible for the trouble. It is not often that the points of the plug become so far contaminated with carbon to completely close up, thereby short circuiting the plug and causing it to become dead.

The most common cause of short circuit in a spark plug is through the electrode becoming covered with carbon, and becoming short circuited by this with the iron jacket of the plug. When you take the plugs out, completely scrape them inside and as far down as can be reached with a pointed scraper, such as a twine needle used for sewing wheat bags; this makes a good tool for the purpose. When the plug has been completely cleaned, pour some petrol inside it and burn it out. The points should be set to an approximate distance of $\frac{1}{32}$ of an inch. It will be found that this spacing gives the best results under all conditions.

A common cause of plug trouble is a cracked porcelain, which is often not easily discernible as the plugs, particularly on tractors, become covered with dust and dirt. The plugs should be regularly inspected every week, and their condition ascertained. We often hear of tractor owners who boast that they have never taken the plugs out of their machine in twelve months. This is extremely bad practice. A plug giving a weak spark causes only partial combustion of the charge; this results in poor power, wasteful running and excessive dilution of the crank case oil by the unburned portions of kerosene which find their way between the piston and cylinder wall into the crankcase. In order to ascertain the type of spark being given by the plugs, take them out, attach them to their connecting wires and lay them on the cylinder head. Switch on the ignition and turn the engine over fairly fast by the crank handle; and observe the sparks jumping between the plug gaps. A thin, blue spark is a weak spark. The ideal colour is red and fat. Obviously, a faulty spark may not always be due to the plug itself—it may be caused by some weakness in the ignition system.

Very often, particularly during harvest when the tractor is working full time and there is no leisure in which to give attention to mechanical details, work has to be gone ahead with an imperfectly operating machine.

Valves.

There is no doubt that the valves, particularly the exhaust valves, of internal combustion engines have to withstand greater heat than any other working part. We are dependent on them for compression and, therefore, operating efficiency; and they consequently demand from us a reasonable amount of care and attention.

In a four-cylinder tractor engine working at, say, 1,200 revolutions per minute, each inlet and exhaust valve is opening and shutting 600 times per minute, or ten times each second. The inlet valve opens to admit ten charges of gas to each cylinder per second; the exhaust valve opens to discharge ten exhausted explosions. When it is realised that the heat in the combustion chamber at the point of explosion is approximately 3,000 deg. Fahr., we begin to wonder how the exhaust valves ever retain the surface and hold the compression. Obviously, extensive use of the motor must, in time, cause the exhaust valve to become burned and pitted, resulting in loss of compression, poor power, and uneconomical running. This can only be corrected, and cannot be obviated.

The term "grinding in the valves" is familiar to all of us, but the actual method of procedure is not so well known; and, in order to assist those who would like to do the work themselves, we give the following method:—

Having removed the cylinder head, the valves should be removed from the cylinder block by releasing the valve cotters and springs. Before removing them from their seats, number each valve by lightly tapping with a punch in order that

you will be certain of putting each valve back in the pocket from which it came. Examine the valve seats in the cylinder block, and if they are badly burned or pitted they should be cleaned up with a refacing tool, which is obtainable at little cost. This is a cutting instrument which is easy to apply and which, if used properly, results in the seat being properly faced and, what is highly important, faced at the correct angle.

Having scraped the valves clean of carbon, place each one in its corresponding guide and commence grinding the seat of the valve to correspond with the seat in the cylinder block. A proper grinding paste is obtainable for this; or a very fine emery mixed with oil can be used. Apply a small portion of this to the valve seat and, using a screw driver, rub the valve into the seat with a semi-rotary motion until the grinding paste reduces the seat of the valve to a fine, even, and polished surface corresponding exactly with the seat in the cylinder block. Having accomplished this with all valves, replace springs and cotters and adjust the valve tappets to allow for clearance between the end of the valve stem and the tappet. This clearance should amount to approximately five or six thousandths of an inch. If this clearance is not allowed, the heat expands the valve and it will ride on the tappet and not on its seat, resulting in poor compression.

Regular attention to the valves is essential for economical running. Good fuel plays an important part in the amount of attention which is required to keep the valves in perfect condition. A slow-burning fuel means that, instead of hot gases being thrust past the exhaust valves, the actual flame itself meets the valve seats, and the result is more extensive and quicker pitting of these surfaces.

THE ROYAL SOCIETY OF QUEENSLAND.

MAY MEETING.

The ordinary monthly meeting was held in the Geology Lecture Theatre of the University on Monday, 26th May, at 8 p.m. Included in the attendance were Professor Sir E. T. Edgeworth David, Professor E. W. Skeats, Dr. P. Marshall, Dr. L. K. Ward, Dr. C. Fenner, Mr. J. F. Bailey, and Professor Summers.

Mr. C. T. White exhibited a specimen of the fruit of *Parinarium laurinum* A. Gray, picked up on the beach at the southern end of Moreton Bay by Mr. Densil Curtis. Fruits of this tree, which is a native of the Solomon Island and New Guinea, are sometimes picked up on the Queensland beaches, but the species so far as known has not yet succeeded in establishing itself here.

Dr. E. O. Marks read a paper entitled "The Physiographical Significance and Non-Migration of Divides."

Where, owing to comparative shortness or other denudational advantage, one stream is more active than its neighbour, it will erode its basin more rapidly, and encroach on the neighbouring basin. This shifting of the divide, known as migration or headward erosion, is generally recognised as a very active physiographical principle, and on it is based the theories of river-capture and rearrangement of drainage which figure largely in modern physiography.

In this paper it is pointed out that, according to the theory, any originally straight divide must be made crooked by the irregular action of this headward encroachment. Consequently any straight divide must have a tectonic origin and still be in its original position.

The Blackall-D'Aguilar ranges form such a straight divide, separating the group of numerous short streams running eastwards into the sea from the headwaters of the Stanley and Mary rivers. On Mount Mee and Blackall tablelands the divide is at 1,500 ft. elevation, but for 10 miles between these is about 500 ft. Here the rocks are soft and differential denudation obviously accounts for the lower elevation and different character of this part of the divide. Although the short streams have courses entirely on soft sandstone country, while the Stanley waters have 180 miles to go largely over hard rocks, and although there is clear evidence of the lowering of this part of the divide by denudation at least 1,000 ft., there has been no migration, and this in a situation where it would necessarily have occurred had the theory been correct.

Other straight divides confirm this absence of migration in situations where the theory would require it, except to such a minor degree as to render it utterly incapable of the results claimed for it.

It is necessary, therefore, that all that part of physiographical theory depending on the migration must be seriously modified if not entirely discarded.

Some inquiry is made to discover the flaw which renders the theory inconsistent with the observed results of these nature-performed experiments.

This paper was discussed by Professor Sir Edgeworth David, Drs. Ward, Fenner, Marshall, and Bryan, and Messrs. Bennett and Jones.

Mr. Perkins read extracts from a paper by B. B. Grey, entitled "Chaetognatha from the Society Islands."

The *Chaetagnatha* discussed in this paper were collected in sixteen hauls, irregularly spaced over a period of twelve months. Ten species are represented, belonging to two genera, *Sagitta* and *Pterosagitta*, including *S. oceania* n. sp. A table illustrating the coincident occurrence of the species is included. *Sagitta oceania* n. sp. is described as new to science, the description being supplemented by several text figures. The fertilisation of the *Chaetognatha* is discussed, special reference being made to observations on *S. oceania* and *S. enflata*. A brief account is given of the parasites found in four species of *Sagitta*. A meal taken by *S. enflata* is described in detail, the meal being a specimen of *S. fridrici*.

The following paper was laid on the table:—"Essential Oils from the Queensland Flora, Part 2, *Agonis abnormis*," by T. G. H. Jones, D.Sc., and M. White, M.Sc.

Examination of the essential oil obtained from the leaves of *Agonis abnormis* (yield ·6 per cent.) has shown that it possesses the following constants:—$d_{15\cdot5}$, ·9040, $n\frac{20}{D}$, 1·4905, [*a*] D, + 9, Ester number 7·4 Acetyl value 16, Acid number 1·7, and is composed of a mixture of d *a*-pinene 30 per cent., aromadendrene 60 per cent., and a small percentage of sesquiterpene alcohols. The aromadendrene fraction is being further examined and at least two sesquiterpenes are present.

JUNE MEETING.

The ordinary monthly meeting was held in the Geology Lecture Theatre of the University on Monday, 30th June. The President, Mr. J. B. Henderson, was in the chair. Messrs. F. Barker and J. B. Wadley were unanimously elected members of the Society.

A paper, entitled "The Genus Oxyscelio: Its Synonymy and Species, with the Description of One New Genus," by Mr. A. P. Dodd, was laid on the table.

This paper discusses the characters of the Scelionid genus *Oxyscelio* Kieffer, erected with *O. foveatus* Kieffer from Java as the genotype. The genera *Camptoeleia* Kieffer, *Dicroteleia* Kieffer, and *Xenoteleia* Kieffer are regarded as synonyms of *Oxyscelio*, the reasons for making these alterations being given at length. Many species originally described or formerly placed in the genera *Sceliomorpha* Ashmead, *Hoplateleia* Ashmead, *Psilanteris* Kieffer, and *Scelio* Latreille are transferred to *Oxyscelio*, which will now contain 32 listed species from Ceylon, the Philippine Islands, Java, and Australia.

The characters of *Oxyscelio* are compared with those of related genera. A new genus, *Bracalba*, is erected to contain *Chromoteleia nigrescens* Dodd and two new species, *Bracalba laminata* and *B. cuneata*, all from Australia, *B. laminata* being selected as the genotype.

The main business of the evening was the following series of exhibits:—

Dr. L. Bagster conducted some very interesting experiments with liquid air, and showed a metallic spectrum on the lantern screen.

Mr. E. J. Wood, M.Sc., exhibited specimens of the following diseases of sugar cane from the collection of the Bureau of Sugar Experiment Stations:—(1) Physiological: Chlorosis (deficiency), banded chlorosis (the effect of cold moist nights). (2) Virus: Two specimens showing Mosaic (Fiji) disease, which, though not shown by the experimenter to be transmitted by inoculation or by insects, has X bodies which seem to indicate its virus nature. Dwarfing is a disease which seems to be new to science. It has not been reported from any other country, and 66 stools of is are known. It resembles Fiji disease in its symptoms, except that the galls are replaced by chlorotic areas somewhat similar to Mosaic. It is a phloem disease and is transmissible through sets, as has been proved by the writer, who is at present working on the etiology of the disease. Its symptoms suggest a virus disease, but artificial inoculations have not yet succeeded. (3) Bacterial: Gumming (*Bacterium vascularum*); Leaf Scald (*B. albilineans*); and Top Rot, a bacterial

disease not confined to the vascular tissue. (4) Fungal: Downy Mildew (*Sclerospora sacchari*), Pokkah Boeng, and Knife Cut (presumably *Fusarium moniliforme*). A number of root diseases of fungal origin were exhibited. Peg Leg is a butt infection of the Bundaberg-Childers areas and clayey Mackay soils. *Schizophyllum commune* is a secondary parasite of little importance. (5) Phanærogamic Parasites: *Striga* spp., which are short-lived, flourishing from December to February. (6) Teratological: Hairy Root, a rare abnormality.

Dr. D. A. Herbert exhibited: (1) Haustoria of *Olax retusa*, a phanærogamic parasite attacking *Gahnia* sp.; the haustoria were the size of a pinhead, and were collected at Burleigh, June, 1930. (2) A French bean seed with two embryos. (3) *Phragmidium disciflorum*, a rust of the rose on the variety Star of Queensland (uredospore stage). (4) A section of a stem of a liana, *vitis acetosa*, with exceptionally long and wide vessels.

On behalf of Mr. E. C. Tommerup, B.Sc., specimens were exhibited of Hoop Pine (*Araucaria Cunninghamii*) showing heat girdling, which he has investigated in conjunction with Mr. R. B. Morwood, M.Sc. The stem and crown die, the roots remain vigorous and often throw off coppice leaves at ground level. At the ground level, however, a collar-like construction is formed, and though the bark is unbroken the water supply is evidently cut off and the tree dies. Plantation trees of two or three years' establishment may be affected. The girdle is often associated with slight swellings above and below the constriction; when the bark is peeled away, dark necrotic rings may be seen above and below the lesion. This disease has been reported from Reserve 151, Neumgna, in the Bunya Mountains area, and from Reserve 220, Kilkivan. Both these areas are on the ecological limit of the rain forests and only receive about 35 inches of rain per annum, with a mean summer temperature of approximately 80 deg. F. Although Bunya Mountains area is one in which the pines are frequently affected by fungal growths, it is considered that this condition exists because the trees are struggling for a living and are more susceptible to fungal attack than are vigorous trees, rather than that the meteorological conditions of this locality are favourable to fungal incubation. The plants attacked are nearly always in exposed situations on heavy soil. Several possible factors were considered, such as wind, damping, fungus, insect injury, frost, &c., but it was eventually decided that it was primarily due to the heating effect of the soil when exposed directly to the sun's rays. Similar diseases are recorded from U.S.A. with other conifers.

Dr. J. V. Duhig, on behalf of Professor Goddard and himself, showed two fish of the species *Galaxias o'connori* (Ogilvy) which had suffered from melanosis. Dr. Duhig showed lantern slides of sections of the skin of the fish. The pigmentation was shown to be due to heavy deposits of what is believed to be melanin about the walls of rounded or oval sub-epithelial cysts, which are lined with epithelium and are, in reality, processes budded off from the skin epithelium. Another section showed these cysts to contain a parasite, which Dr. Goddard stated to be the metacercaria stage of a trematode, *Clonorchis* (? species). A section was shown demonstrating the ventral sucker by which the genus could be identified. The fish is the second intermediate host of the parasite and the authors propose to continue their investigations in the direction of feeding experiments in order to secure the adult worm. To this end they desire specimens of sick fish which are well pigmented. The exhibit had a double interest, in that it raised the problem of melanin production and the subject of the exhibit was an indigenous species to which little attention had been paid.

Mr. C. T. White exhibited specimens of *Datura ferox* Linn. from Clermont, Central Queensland. The species, which is supposed to be a native of Spain and Sicily, was first collected in Queensland at Macalister, Western Darling Downs, by E. W. Bick about March, 1916. Since then it has spread to other places, but Clermont represents the northernmost locality so far recorded.

Professor H. C. Richards, D.Sc., exhibited several beautiful specimens collected by Mr. A. N. Falk of the zeolite Natrolite, from vughs within the weathered olivine basalt on the Main Range some 2 to 3 miles south-east of Toowoomba. He offered remarks upon the origin of the mineral, its crystalline habit, and how it may be distinguished from other zeolites.

Mr. E. W. Bick exhibited a specimen of flowers of *Spathodea campanulata*, the tulip-tree of West Africa. The unopened flower-buds of this species contain a considerable quantity of water of glandular origin. The plant is sometimes known as the fountain-tree on account of the behaviour of the buds when punctured.

Mr. J. E. Young exhibited matted fibrous roots of *Casuarina suberosa*, which had grown in a blanket-like mass in the crevices of consolidated sand on Stradbroke Island.

ABSTRACTS AND REVIEWS.

Fungous Diseases of Plants.

Jacob Ericksson 2nd ed., Bailliere, Tindall and Cox, London, 1930, 35s. A recent addition to the library Ericksson: Fungous Diseases of Plants.

This book covers a very comprehensive field describing clearly all the more important European plant diseases and giving in most cases the recognised control measures. A short bibliography is appended to the disease under discussion. Briefer reference is also made to the symptoms and etiology of the less common diseases.

Elementary Practical Agricultural Chemistry.

E. M. Joiner, B.Sc., Senior Science Master, Dookie Agricultural College, Victoria, Robertson and Mullens, Ltd., Melbourne, 6s.

A useful little book suited to any student of agriculture who seeks a knowledge of simple analytical operations for the testing of products used in agriculture, both qualitatively and quantitatively.

Live Stock of the Farm. (6 Vols.)

Edited by Professor C. Bryner Jones, M.Sc., F.H.A.S., Agricultural Commissioner for Wales under the Board of Agriculture and Fisheries (Great Britain), and Chairman of the Welsh Agricultural Council. Gresham Publishing Company, Limited, London. Queensland Book Depôt, £2 set.

The subject of this work is of great importance to Australia. The value of stock breeding has never been so widely recognised as at the present time, nor has it in its many aspects received closer or more general attention. Schemes for stock improvement, and the means for the investigation of scientific problems connected with animal husbandry are comparatively new movements in this country, which will certainly be attended in time with far-reaching results. Already they have invested the work of stock breeding with an interest and a significance in our national outlook.

Every part and aspect of the subject is dealt with, as far as possible, in a manner consistent with the object in view in these fine and well printed and illustrated volumes. They include the work of many writers, each a specialist in his subject, whose name is well known to breeders in every stock-raising country. The whole work is a comprehensive, complete, and practical treatise on Live Stock on the Farm. The editor, contributors, and publisher alike have obviously spared no effort to make it, whether in its general conception, its arrangement, or the character of its contents, a really useful book of reference to the farmer and stock breeder.

Each volume of the set of six is replete with many plates depicting typical specimens of the breeds of livestock with which it deals. Volume I. covers the Principles of Breeding; Breeds of British Cattle; the Improvement of Cattle; and the Selection and Judging of Cattle. The contents of the other volumes include:—Volume II.—The General Management of Cattle. The Feeding of Cattle. The General Principles of Animal Nutrition. Diseases of Cattle. Volume III.—Breeds of Horses. The General Managament and Feeding of Heavy Horses. The Management of Light Horses. Common Diseases of the Horse. Volume IV.—Sheep Farming. Breeds of Sheep. General Management and Feeding of Sheep. Diseases of Sheep. Volume V.—Breeds of British Pigs. The Management and Feeding of Pigs. Bacon Curing. Diseases of Pigs. Breeds of Poultry. The Management and Feeding of Poultry. Profitable Poultry Farming. Diseases of Poultry. Volume VI.—Bees and their Management. Goats and their Management. Dogs and their Management. Ferrets and their Management. Asses and Mules.

A comprehensive index completes a very useful work that should find a place on every farmer's book shelf.

Our copy is from the Queensland Book Depôt, Epworth House, 232-4 Albert street, Brisbane.

Through the advantage of a special purchase the management of the Queensland Book Depôt is able to offer the complete set for £2, a charge very much below the publishing price.

The Young Farmer.

NOTES ON CALF FEEDING.

Contributed by C. F. McGRATH, Supervisor of Dairying.

No fixed rules can be laid down for the feeding of calves, because the feeding depends not only upon the age of the calf, but also upon its size, health, and vigour. Therefore the quantities of feed mentioned in the following table are to be taken as guides only—to be decreased or increased according to the experience gained from the feeding of any individual calf.

The young calf has a small stomach, and the calf when running with its mother takes milk frequently and in small quantities. Therefore, in hand feeding, the greatest care must be taken not to over feed with milk of any description. Too large an allowance of milk produces indigestion and scour.

When a young calf has been without feed for some hours and is then allowed to take as much milk as it will, it is apt to gorge itself, thus causing digestive troubles.

Milk.

A calf, weighing somewhere about 50 lb. at birth, for the first few days should be given from 5 to 8 lb. per day of its mother's milk, divided amongst four feedings. Somewhat more is given to a calf weighing about 100 lb. at birth—viz., 8 to 10 lb. per day of the mother's milk distributed over four feedings.

All milk fed should be at blood heat—viz., from 95 deg. to 100 deg. Fahr.

If the calf is healthy and strong, at about ten days old the whole milk may be gradually replaced with separated milk.

Grain.

When from two to three weeks old the calf can be taught to eat ground grains or concentrates, by placing a little of the ground grain or concentrate at the bottom of the tin from which the calf has just finished drinking its milk.

Ground grains include such material as maize meal, bran and pollard, ground oats, Kaffir corn meal, barley meal, &c. Better results are obtained by feeding a mixture of grain, than by feeding one grain alone.

Concentrates.

Concentrates include linseed, cocoanut and peanut cake and meals, and calf foods.

When the concentrate is entirely linseed meal it must be first mixed to a smooth paste with a little water, then more water added and the mixture boiled from ten to twenty minutes, before being fed to young calves.

Feeding Tables.

As before stated, the following tables are to be used as guides only. The time when feeding milk should stop depends upon a number of conditions—viz., whether the calf is strong and healthy, and if food other than milk, such as good hay and grain and young pasture is available.

As a rule, not more than 18 to 20 lb. of milk per day are fed to calves.

The amount of lucerne hay given to young calves should not be excessive, as such excess is liable to cause scour.

Any uneaten lucerne, oaten or wheaten hay or chaff, ground grain, or concentrate, should be removed and feeding vessels cleaned, and fresh material given for the next feed.

Additional Mineral Requirements.

A mixture of 1 part by weight of salt with 2 parts by weight of finely sterilised bonemeal or 2 parts of finely ground Nauru phosphate should be dusted over the ground grain or concentrate ration.

Substitute for Separated Milk.

If separated milk is not available, dried skim milk powder, or dried butter milk may be used by taking 1 lb. of either of these materials and mixing with 9 lb. of water, and using such mixture in the same way as separated milk is used in Table No. 1 or Table No. 2.

TABLE No. 1.—Feeding Cod-liver Oil and Ground Grains in addition to Milk, Hay, and Pasture.

(Compiled by E. H. Gurney, Senior Analyst.)

Age.	Feeding Period per day.	Whole Milk per day.	Separated Milk per day.	Clean Water.	Cod-liver Oil per day.	Ground Grains per day.	Hay.	Pasture.
		Lb.	Lb.					
1 week..	3 times	8·0	..	..	..	..	..	..
10 days..	Twice	8·5	0·5	..	..	..	..	..
11 days..	ditto	8·0	1·5	..	..	..	..	..
12 days..	ditto	7·5	2·5	..	..	..	..	..
13 days..	ditto	7·0	3·5	..	..	..	..	..
14 days..	ditto	6·0	4·5	Access to	2 teaspoonsful	A little	A little	..
15 days..	ditto	5·0	5·5	ditto ..	ditto ..	ditto	ditto	..
16 days..	ditto	4·0	6·5	ditto ..	4 teaspoonsful	ditto	ditto	..
17 days..	ditto	3·0	7·5	ditto ..	ditto ..	ditto	ditto	..
18 days..	ditto	2·0	8·5	ditto	2 tablespoonsful	ditto	ditto	..
19 days..	ditto	1·0	9·5	ditto ..	ditto ..	ditto	ditto	..
20 days..	ditto	0·5	10·5	ditto ..	ditto ..	ditto	ditto	..
21 days..	ditto	..	12·0	ditto ..	3 tablespoonsful	5 to 6 oz.	*Ad lib.*	On pasture
22 days..	ditto	..	13·0	ditto ..	ditto ..	ditto	ditto	ditto
23 days..	ditto	..	14·0	ditto ..	ditto ..	ditto	ditto	ditto
24 days..	ditto	..	15·0	ditto ..	ditto ..	ditto	ditto	ditto
25 days..	ditto	..	15·0	ditto ..	ditto ..	ditto	ditto	ditto
26 days..	ditto	..	16·0	ditto ..	ditto ..	ditto	ditto	ditto
27 days..	ditto	..	17·0	ditto ..	ditto ..	ditto	ditto	ditto
28 days..	ditto	..	18·0	ditto ..	ditto ..	ditto	ditto	ditto
5 weeks	ditto	..	20·0	ditto ..	ditto ..	ditto	ditto	ditto
6 weeks	ditto	..	20·0	ditto ..	ditto ..	8 oz.	ditto	ditto
2 months	ditto	..	20·0	ditto ..	..	1 lb.	ditto	ditto
3 months	ditto	..	20·0	ditto ..	..	1½ to 2 lb.	ditto	ditto
6 months	ditto	..	20·0	ditto ..	..	2 lb.	ditto	ditto

TABLE No. 2—Feeding Concentrates in addition to Milk, Hay, and Pasture.

Age.	Feeding Period per day.	Whole Milk per day.	Separated Milk per day.	Clean Water.	Concentrate per day.	Hay.	Pasture.
		Lb.	Lb.				
1 week..	3 times	8·0	..	..	..	..	..
10 days ..	Twice	8·5	0·5	..	..	..	..
11 days ..	ditto	8·0	1·5	..	..	..	..
12 days ..	ditto	7·5	2·5	..	..	..	..
13 days ..	ditto	7·0	3 5	..	..	..	..
14 days ..	ditto	6·0	4·5	Access to	A little ..	A little ..	..
15 days ..	ditto	5·0	5·5	ditto ..	ditto ..	ditto ..	..
16 days ..	ditto	4·0	6·5	ditto ..	ditto ..	ditto ..	..
17 days ..	ditto	3·0	7·5	ditto ..	ditto ..	ditto ..	..
18 days ..	ditto	2·0	8·5	ditto ..	ditto ..	ditto ..	..
19 days ..	ditto	1·0	9·5	ditto ..	ditto ..	ditto ..	..
20 days ..	ditto	0·5	10·5	ditto ..	ditto ..	ditto ..	..
21 days ..	ditto	..	12·0	ditto ..	5 to 6 oz. ..	*Ad lib.* ..	On pasture
22 days ..	ditto	..	13·0	ditto ..	ditto ..	ditto ..	ditto
23 days ..	ditto	..	14·0	ditto ..	ditto ..	ditto ..	ditto
24 days ..	ditto	..	15·0	ditto ..	ditto ..	ditto ..	ditto
25 days ..	ditto	..	15·0	ditto ..	ditto ..	ditto ..	ditto
26 days ..	ditto	..	16·0	ditto ..	ditto ..	ditto ..	ditto
27 days ..	ditto	..	17·0	ditto ..	ditto ..	ditto ..	ditto
28 days ..	ditto	..	18·0	ditto ..	ditto ..	ditto ..	ditto
5 weeks	ditto	..	20·0	ditto ..	ditto ..	ditto ..	ditto
6 weeks	ditto	..	20·0	ditto ..	8 oz. ..	ditto ..	ditto
2 months	ditto	..	..	ditto ..	1 lb. ..	ditto ..	ditto
3 months	ditto	..	..	ditto ..	1½ to 2 lb.	ditto ..	ditto
6 months	ditto	..	..	ditto ..	2 lb. ..	ditto ..	ditto

Answers to Correspondents.

BOTANY.

The following answers have been selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.:—

"Thorn Apple."

L.D.C. (Emerald)—

The specimen is *Datura ferox*, a species of thorn apple, an ill-smelling, coarse annual weed that first made its appearance on the Western Darling Downs about 1916. Since then it has spread, though rather slowly, to other parts of the State. The whole plant, like others of the genus is poisonous. We cannot say how the plant came here, and there is some doubt about its native country. It is generally regarded, however, as native to Spain and Sicily. Attention was drawn to the plant by means of an article and illustration which appeared in the "Queensland Agricultural Journal" for July, 1917.

Mission, Sour, or Yellow Grass.

A.H.K. (Woombye)—

Your specimen is *Paspalum conjugatum*, the Mission Grass, or more commonly known in Queensland as Sour Grass or Yellow Grass. On the Atherton Tableland, where this grass is very abundant, it is looked upon as very poor fodder for dairy cattle, and also tends to overrun a pasture to the exclusion of better grasses such as ordinary Paspalum and Rhodes. Cows are said to milk very poorly on it. The grass is very common throughout the Pacific, and we have seen working mules in New Guinea do quite well on it in the absence of other fodder. Nevertheless, the experience of practical dairy farmers in Queensland is that the grass is practically useless from a dairying standpoint. Seed is not stocked by the nurserymen.

Wood-Sorrel.

V.J.B. (Miles)—

Your specimen is not a clover, but *Oxalis corniculata*, a species of wood-sorrel. It has no particular value as a fodder.

Grass (*Neurachne*) Identified.

N.A.R.P. (Townsville)—

Your specimen of grass is an undescribed species of *Neurachne*. I collected some of the grass myself some years ago at Barcaldine. It will be named and described when Mr. Hubbard is publishing his account of the Queensland grasses. The genus is only a small one but contains some quite good fodders, one of the best known of which is *Neurachne Mitchelliana*, the so-called Mulga Mitchell moderately abundant in parts of South-western Queensland and Northern New South Wales.

Black Mauritius Bean.

F.A.G. (Townsville)—

The name of the bean from Innisfail is *Stezolobium aterrimum*, popularly known in Queensland as the Black Mauritius Bean, fairly extensively grown throughout the tropics as a green manure, especially for cane fields. The plant has long been known in cultivation, but its exact native country is not known. The beans, so far as we know, have no value at all as food for stock. The bean is sometimes confused with the Florida Velvet Bean, but this is really a different plant.

Alton Downs Blue Grass (*Andropogon nodosus*).

G.B.B. (Rockhampton)—

Your specimen of grass has been determined by Mr. Hubbard, of the Kew staff, who is now in Brisbane working on Queensland grasses, as *Andropogon nodosus*, a native of India. In the nomenclature now adopted the name of the grass would be *Dichanthium nodosum*, the genus *Andropogon* as understood by older authors having been divided up into a large number of

smaller ones. The species was originally described from specimens collected in Mauritius. It has also been found in India, Bourbon, Rhodesia, New Caledonia, and the West Indies. It is probably a native of India and has been introduced elsewhere. Lisboa (List of Bombay Grasses) states that it is used as a fodder in the Bombay district. Specimens were first sent to the Herbarium in May, 1917, from Alton Downs by Mr. Brooks. Later (March, 1926) it was received from Mr. A. H. W. Cunningham, of Strathmere, Bowen. Mr. Quodling forwarded specimens last April which he had collected from the grass plots at Archer. He gave the common name as "Alton Downs Blue Grass." The specimen was then named *Andropogon annulatus*. The latter is a distinct Indian and African species, and has not been found in Queensland. This grass has been usually placed as a variety of *Andropogon caricosus* L. It differs from that species in its more robust habit, longer awns, and in the peduncles of the racemes and the apex of the culms being densely pubescent.

Needle Burr.

R. S. (Bundaberg)—

Your specimen is *Amarantus spinosus*, a native of tropical Asia, a common annual weed in most tropical and sub-tropical countries, including Queensland. It is most popularly known in Queensland as needle burr, and is most abundant on the Atherton Tableland. It is not poisonous in any way, as a matter of fact is recorded as being used as spinach by the Asiatics in times of scarcity of food. A number of weeds allied to it, common in India and Australia, are used in the same way.

Grasses—*Chloris barabata*, a Native Panicum. *Crotalaria striata*.

J.H. (Cairns)—

The grass with the purplish seed-heads is *Chloris barabata*, a species allied to the Rhodes grass and very common in Central and North Queensland. Some years ago it was boomed somewhat as a fodder, but later experiences did not seem to bear this out. The smaller grass is *Panicum distachorum*, a native Panic grass, rather valuable both for forage and hay purposes. The weed is *Crotalaria striata*, a plant poisonous to stock, though apparently not often eaten by them. A pamphlet reprinted from the "Queensland Agricultural Journal" has been posted for your information.

Stagger Weed. Mallow.

C.F.W. (Kingaroy)—

Of your two specimens, one in flower is the Stagger Weed, *Stachys arvensis*, a very common weed in cultivation paddocks in Queensland and proved by feeding experiments to cause "staggers" in working stock. Resting stock such as dairy cows do not seem to become affected by it. It is also commonly known as Wild Mint or Mint Weed, though this name is applied to a number of allied plants in addition. The other specimen bore neither flower nor seed, but we should say it represents a seedling growth of the common Mallow, *Malva parviflora*, which has been proved to cause "shivers" or "staggers" in stock also, as proved by feeding experiments in New South Wales, but we have never heard of any trouble being caused by the plant in Queensland. We think it is only when the plant is in very great abundance and of a very tall vigorous growth that any trouble is experienced.

Polypore (fungus).

D.A.W. (Fraser Island)—

The specimen represents the underground or mycelial stage of a species of Polypore. The Polypores are fungi found both growing in the ground and on trees and dead wood. Their chief characteristic is that the spore-bearing surface is covered with a number of minute pores or pits. These underground tubers are occasionally dug up in Australia and are generally regarded as representing one species, *Polyporus Mylittae*, but that cannot be proved of course, as fruiting buds are so rarely produced. The fruiting bud comes up in the form of mushroom-like plants above the surface of the ground. They have been known to send out these fruiting buds when put away in museum cases. The tubers are supposed to have been eaten by the natives in the early days, hence the name, sometimes applied, of Blackfellow's Bread.

Poison Peach. *Cassia.*

M.K. (Mt. Fox, Ingham)—

If you wish to learn the names of the various weeds and undergrowth on your property and the report on their properties, we would advise you to send specimens for identification. The specimens should consist of a shoot a few inches long and bearing either flowers or seeds; they should be dried flat between sheets of newspaper for a few days before sending. They should also be numbered, a duplicate being kept similarly numbered for checking for identification when the report on them is received.

The plant you describe as Wild Peach or Poison Peach is *Trema aspera*, generally regarded as very poisonous, though we have at times seen stock eat freely of the plant without ill-effects following. The trouble is the formation in the leaves of a prussic-acid-yielding glucoside which only occurs now and again, and what controls its presence and absence is not known. The plant you describe as Arsenic Bush is, we should say, a species of *Cassia*. This plant generally causes severe purging in stock if eaten in quantity, but on the whole no ill-effects follow.

Grasses, North Queensland Coastal Country.

Inquirer (Innisfail)—

Rice Grass (*Spartina Townsendii*) is quite unsuitable for your locality. It is essentially a cold country plant and we are practically certain that the climate, even as far south as Brisbane, is too hot for it. Probably for your purpose the best grass is *Panicum muticum*, common everywhere in North Queensland and generally regarded as a valuable grass for binding river banks. It has the advantage of being a very rapid grower. Another grass that could be tried is the common Buffalo Grass (*Stenotaphrum americanum*). Where land is muddy and subject to covering by the tide you could try the Common Reed (*Phragmites communis*). This species grows quite well in moderately salt water and is fairly common in parts of North Queensland. We do not remember seeing it on the Johnstone, but it is almost sure to be there, as it is fairly common about Cairns. You mention small bamboos. These are worth trying, but for rapidity of growth probably the Spanish Reed, some times called the Small Bamboo in Queensland (*Arundo donax*) would be worth planting. You do not state whether soil is muddy or sandy, but we think it would be advisable to make at least trial plots of all these grasses.

Bird's-foot Trefoil.

Inquirer (Sydney, N.S.W.)—

Bird's-foot Trefoil (*Lotus australis*) is more a constituent of Southern pastures than it is in Queensland, though it does grow here practically everywhere, though not usually in very large quantities. It has been proved poisonous, the poisonous property being a prussic acid yielding glucoside, such as is present in young Sorghum and some other plants. It is poisonous to stock, especially if eaten in quantities and on an empty stomach. We cannot say the exact amount necessary to kill a beast, but in any case this would vary very considerably with the condition of the animal. Possibly quiet browsing stock would be unaffected by it, as they so often are by these prussic acid producing plants.

Measurement of Log Timber.

J.H.P. (Buderim)—

To find the superficial feet of timber in a tree, take one-quarter of the circumference or girth in inches, multiply by itself, then multiply by the length of the log in feet, and divide by 12; or, if the girth does not divide by four evenly, multiply the full girth in inches by itself, and by the length in feet, and divide by 192. That is the general rule in use by Queensland timber men. A log 50 inches in girth and 20 feet long would yield by this method of calculation 260 superficial feet.

General Notes.

Staff Changes and Appointments.

Mr. J. J. Purcell, Temporary Stock Assistant, has been exempted from the operations of Section 18 (3) (*v*) of the Public Service Acts, and his services have been continued for the period from the 1st July, 1930, to the 31st December, 1930.

Messrs. C. A. M. Reid and C. J. Loseby, of Indooroopilly, have been appointed Honorary Rangers under and for the purposes of the Animals and Birds Acts for the newly created Sanctuary at "Lone Pine."

Mr. C. Dorrell (Yanko Station, via Thargomindah), Mr. E. G. Conrick (Nappamerrie Station, via Nocundra), and Mr. M. A. Seagar (Daymar, via Thallon), have been appointed Honorary Inspectors of Stock as from the 19th July. Mr. W. C. Mylrea, of Leura Station, via Marlborough, has been appointed an Honorary Ranger under the Animals and Birds Acts. The services of Messrs. F. C. Shaw and P. J. Short, Temporary Inspectors of Slaughterhouses at Cairns and Warwick respectively, have been continued from the 1st July to the 31st August.

Mr. K. V. Henderson, Field Assistant, Callide Cotton Research Station, Biloela, has been transferred to Waratah, in the Upper Burnett District.

Mr. H. Flanagan, Inspector of Slaughter-houses, Bundaberg, has been appointed also an Inspector of Brands.

The Brisbane Show.

The House of Pike Brothers, Queen street, extends to country visitors for the Show a cordial invitation to call and make themselves known. Many different departments at Pike Brothers cater completely for the man out of town and many visitors make it a regular practice to stroll through the store and note the many items of apparel that are introduced for their especial benefit from time to time.

Sanctuary for Animals and Birds—Brisbane Catchment Area.

An Order in Council has been issued under the Animals and Birds Acts declaring the Brisbane Water Catchment Area, Mount Coot-tha Reserve, and adjoining lands to be a Sanctuary under the Animals and Birds Acts.

Most of this land has been declared sanctuaries at various times since 1885, and the new Order in Council consolidates the blocks into one sanctuary, with the addition thereto of certain other blocks. Roughly, the sanctuary now takes in the whole of the parish of Kholo, and portions of the parishes of Chuwar, Sahl, Samford, Enoggera, Indooroopilly, and Moggill.

Maps of the sanctuary are being prepared, and these will be displayed at suitable places on the lands concerned.

Tomato Packing—A Handy Wall Chart.

A very useful wall chart, compiled by the Instructor in Fruit Packing, Mr. Jas. H. Gregory, is now on issue to tomato growers at the Head Office of the Department of Agriculture and Stock. As most growers know, correct height and compactness of fruit are essential in the successful carriage and marketing of fruit. In this chart, Mr. Gregory shows, by well reproduced photographs and diagrams, the right way to pack fruit in a simple and graphic way. Every tomato-grower should find a place for it on the wall of his packing shed for ready reference. Application for a copy should be made to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Sectional Group Committee Elections.

On the 8th August, 1929, Regulations 73 to 77 under the Fruit Marketing Organisation Acts, setting out the electorates for the annual elections of the Banana, Pineapple, Citrus, Deciduous, and Other Fruits Sectional Group Committees, were approved. For the elections this year, in the cases of the Pineapple, Citrus, and Other Fruits, the electorate boundaries are slightly different. Accordingly Regulations have been issued rescinding Regulations 74, 75, and 77 made last year, and substituting new ones. These new regulations set out the electorates which will be recognised in the forthcoming elections of the Pineapple, Citrus, and Other Fruits Sectional Group Committees. The electorates recognised in 1929 for the Banana and Deciduous Committees will be again recognised this year.

Sanctuaries for Animals and Birds.

The following places have been proclaimed Sanctuaries under and for the purposes of the Animals and Birds Acts, in which it will be unlawful to kill or capture any Native Bird or Animal:—

(1) The property of Mr. C. A. M. Reid, at Indooroopilly, known as "Lone Pine," a tourist resort, comprising an area of about 32 acres, consisting of portions 130, 138, and 139, parish of Indooroopilly, county of Stanley;

(2) Reserve for Abattoirs, Wolston, R. 1230, parish of Woogaroo, county of Stanley, comprising an area of about 223 acres 2 roods;

(3) Part of the property of Mr. St. J. Robinson, known as "Mount St. John," on the Ingham road, near Townsville, comprising an area of 426 acres, consisting of resubdivision 2 of subdivision 2 of portion 77, parish of Coonanbelah, county of Elphinstone.

Subsidy to Agricultural Societies.

Up to the present, under the Regulations governing the payment of subsidy to Agricultural and Horticultural Societies, no subsidy has been payable to any society, other than those in existence before the 1st July, 1890, which has been or shall be established within a radius of twenty miles of any place in which there is a society in existence. A Regulation has now been passed rescinding the relevant Regulation, so that in future subsidy may be payable to any society established within a radius of twenty miles of any place where a society has already been established.

Baby Beef.

"The baby beef craze is said to have hit the Pacific Coast," a Chicago live stock market paper remarks editorially in a recent issue. There was a time, quite a few years ago, when the demand for baby beef might have been, with some show of justification, denominated as a "craze." The fact is that the trend towards baby beef in recent years has been about the clearest manifestation of sanity in relation to food buying that has been made by any class of consumers. It has been in line with changing living and housing conditions. It made the housewife's money go farther in the purchase of foods, and kept beef on the menu of many a home. It has rebounded to the benefit of the producer of beef cattle, making possible a quicker turnover and eliminating much of the hazard of beef making. If baby beef making is a "craze," it is to be hoped that other lapses from sanity equally as beneficial to the cattle industry and the beef consumers will occur at frequent intervals, says the editor of "The Hereford Journal" in U.S.A.

State Wheat Pool Election Regulations.

Regulations under "*The Wheat Pool Acts, 1920 to 1928*," have been issued rescinding the old State Wheat Pool Election Regulations made in 1926, and substituting new ones therefor. The new Regulations differ from the old ones in the following particulars:—

(*a*) The Minister may now appoint a returning officer to conduct elections, whereas previously the Under Secretary conducted any election.

(*b*) The growers' representatives will be appointed for a period of two years, the first of such periods to commence on the 1st September, 1930; the present Board holds office for one year only.

(*c*) Each representative must now be a bona fide wheatgrower; under the old system, any person is entitled to election as growers' representative on the Board.

(*d*) The Minister may publish the notice calling for nominations, the nominations received, and the result of the elections, in such newspapers as he thinks fit, but in at least one paper circulating in each district; in the revoked Regulations certain papers are specified for each district in which such notices must be published.

(*e*) The voting at all elections will be preferential; under the old system preferential voting is optional.

(*f*) Questions arising in connection with any election shall be decided by the returning officer, not by the Under Secretary as has, until the present, been the case.

(*g*) The Minister has now the power to declare any election invalid, and order another; under the old system he had no such power.

Finance for Barley Board.

An Order in Council has been issued to provide for finance for the Barley Board. This Order sets out the conditions under which the Board may borrow moneys to enable it to carry on its operations, and the manner in which securities may be granted. The conditions are the same as those applied to other Commodity Boards.

The Queensland Canary Seed Board—The Season's Returns.

The Queensland Canary Seed Board completed all operations in relation to 1929-30 crop by 30th June. Board accounts were closed expeditiously, and pool costs were moderate, thus enabling a payment to growers of £28 15s. a ton net, that cannot be other than satisfactory. There came to the pool 280 tons 2 cwt. 3 qr. 14 lb.; the cleanings and gradings totalled 29 tons 2 cwt. 2 qr. 16 lb.; this includes wastage from two especially dirty lots. From one of these lots there was 55 cwt. of wastage through mildew, convulvulus, black oats, and an unknown seed which was most difficult to eliminate. This consignment was put through the cleaning machines several times before it was marketable. Another consignment opened up badly, and a very big parcel of gradings was sent back to the consignor.

The character and quality of the seed is such as to encourage its extensive cultivation, and if given a continuance of the of the well-warranted embargo it will be found a profitable crop to grow. It is doubtful if any other crop yields as good a net cash return. The greatest charge against the 1929-30 crop was the wastage, also the attendant cost of cleaning and grading. In many cases repeated cleaning was necessary, as the Board was determined to market a seed that would in every way compare with Moroccan and other imported seed. The Board earnestly emphasises that if the paddocks are kept clean, weeds kept down, and greater care exercised in harvesting operations, a tremendous wastage would be saved and profit correspondingly increased to the grower. A large proportion of the wastage is made up of broken seed; surely a little care exercised in machine adjustments would well repay the grower and save the seed. A little reflection on the part of growers will convince them that, apart from the loss occasioned by cost of extra cleanings and gradings, there also is the cost of railage on this wastage.

After 1st December, no imported seed will be accepted at any port in the Commonwealth, so it is up to the Darling Downs farmers to honour the confidence which the Federal Government has shown in their splendid soil and climate, and grow at least all the seed that the Commonwealth consumes. The soil will produce the crop; the grower should therefore do his part and market tip-top canary seed. The Australian market can absorb about 1,500 tons of canary seed during the year, so there is plenty of margin for increased acreage.

A New Sanctuary for Native Birds.

Murray's Lagoon, near Rockhampton, was declared to be a Sanctuary for the protection of Native Birds in 1904. An Order in Council has now been passed rescinding this declaration, and declaring Reserve R. 217 (area 690 acres) containing Murray's, Yeppoon, and Crescent Lagoons, parish of Rockhampton, county of Livingstone, to be a Sanctuary under the Animals and Birds Acts, in which it shall be unlawful for any person to take or kill any animal or bird.

No Open Season for Opossums.

The Minister for Agriculture and Stock (Mr. H. F. Walker) has announced for the benefit of trappers and other interested parties, that he desires it to be definitely understood that an open season will not be proclaimed for opossums during the present year. He desires also to point out that no traffic in opossum skins will be permitted, and in this connection the co-operation of the Police and the Railway Department has been sought. The Minister also wishes to impress on trappers the fact that sales of opossum skins cannot be conducted until an open season is again proclaimed.

Regulations under the Farm Produce Agent Actss.

Regulations have been passed under the Farm Produce Agents Acts rescinding all previous Regulations and substituting new ones therefor. The chief difference between the old and new is that the new ones clearly specify the nature of books to be kept by a produce agent. The Registrar, however, is empowered to exempt any agent from adhering to the particular form of accountancy mentioned, provided that the system in use enables all sales to be properly traced. It is now compulsory for an agent to keep all his books and documents at night in a fire-proof safe.

Papaw Levy Regulations.

In 1928 a levy was made on all papaws, for advertising purposes. At the end of 1929 there was an amount of £143 debit outstanding, which has been spent by the Committee of Direction on the growers' behalf. In response to a request from two Local Producers Associations, the Committee of Direction conducted a ballot of papaw growers on the question as to whether a levy be struck again this year in order to wipe off the debt. A total of 226 ballot-papers were posted, and 116 were completed and returned, of which 94 were in favour and 22 against the levy. The Committee of Direction accordingly recommended that additional Regulations be issued under the Fruit Marketing Organisation Acts to provide for this levy, for advertising purposes. As a result, the Governor in Council has now approved that Regulations 189 to 199 under the Acts referred to be issued to provide for a levy on papaws by the Committee of Direction.

The levy shall be payable by growers of papaws marketed from the 26th June, 1930, to the 27th June, 1931, at the rate of one penny per bushel case. The levy shall be collected by all agents, and paid to the Committee of Direction fortnightly. In the case of papaws sold privately, the grower must furnish monthly a statement of realisation of such sales, and pay to the Committee of Direction the amount of levy due. The books of any agent may be inspected by any authorised officer of the Committee of Direction to ascertain whether the Regulations are being complied with. Any person failing to pay the levy, or otherwise committing a breach of these Regulations, shall be guilty of an offence, and be liable to a penalty not exceeding £20.

Swine Fever.

In an address at a recent meeting of the Pig Industry Committee of New South Wales, Dr. H. R. Seddon, Director of the Glenfield Veterinary Research Station, New South Wales, stated that fresh pork may maintain its infectivity for seventy-three days, and it is possible that, under certain circumstances, this period may be longer. So far, all experiments aiming to show that bacon made from infected pigs could spread the disease have been negative, but, of course, that does not prove that bacon and ham are always harmless. It is certain, however, that the danger from bacon, &c., is nowhere near so great as that from fresh or frozen pork.

Mildew on Bacon.

One of the objections to farm-cured bacon is that there is great difficulty in preventing the development of a heavy growth of mould on the cured surfaces after the curing, drying, and smoking processes are complete and the bacon is stored away for future use. The trouble is not a new one; indeed, it has been a source of annoyance both to bacon factories, provision stores, and the farming community for many years, and much loss has been occasioned in subsequently freshening up and trimming goods so affected. Curers and chemists alike have for ages been puzzled over the rapid growth of the mould, but in recent years research has paved the way to much better results, through which, nowadays, there is not nearly the same amount of trouble as formerly. It is apparent that the mildew which develops after the smoking process is complete and the bacon has been stored is largely due to an excess of moisture both in the meat and in the atmosphere. Bacon is not the only class of goods that suffers, especially in the semi-tropical and tropical districts. Some curers even believe that the growth of mildew is encouraged by insufficient even though prolonged drying of the meat, and by the smoking process being carried out in a room or portion thereof which does not allow of rapid and thorough smoking; for bacon is often smoked by merely being hung up on rafters in a smoky kitchen or by being hung up in a chimney away from the heat, yet in the track of the smoke from a continuous fire.

The trouble is not so apparent in cold climates or in dry years, but must be looked for in most parts of Australia, especially during moist or humid seasons. Removal of the mould does not necessarily ruin the bacon or reduce its value, nor does the growth of the mould indicate decomposition, or that the meat is unfit for use, for the mildew is readily cleaned off, and if the meat is then thoroughly dried and rubbed over with a cloth soaked in olive or salad oil it will keep clean for quite a long time. In fact, the growth of mould would be checked very largely if this precaution of oiling be taken in the first instance, as soon as the smoking is complete and the meat has cooled off.

Storing in a dry atmosphere where the temperature is normal to cool will also be effective, though even under the best management there will be a limited growth of mould or mildew in due course. Provided the meat has not been otherwise neglected or depreciated in value and is in good state of prservation, there is no occasion to seriously worry over the appearance of mould.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staff of the Queensland Baby Clinics, dealing with the welfare and care of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable cases of infant mortality.

DIPHTHERIA.

Of all the epidemic diseases which attack our children, diphtheria is the most treacherous and the most terrible; treacherous because it so often begins as a slight sore throat, of which the child may make no complaint; terrible because within two or three days a previously healthy child may be struggling for its life against a blocking of its air passages, or the absorption of a deadly poison, or against both at the same time.

The Seriousness of a Sore Throat.

It is so easy to make mistakes at the beginning of the illness. Diphtheria may be very difficult to distinguish from other forms of sore throat, and diphtheritic croup may be exactly similar to simple croup, except that it lasts longer and, if untreated, is almost surely fatal. If a child has a sore throat, that throat must be carefully examined by a doctor, and if an attack of croup in the night does not disappear in the morning a doctor must be sent for. Of course, some children are subject to attacks of simple croup, but this does not give any assurance that they may not be attacked by diphtheritic croup. Many children have attacks of other kinds of sore throat, so like diphtheria that it needs an expert to distinguish them, and even the expert may be in doubt, and may for safety treat the disease as diphtheria, without being certain as to its nature.

The Cause and Cure.

Science has discovered the cause of the disease to be a living organism—the diphtheria bacillus. The bacillus can be easily grown on jellies and in broths, and as it grows there it secretes its poison or toxin just as it does in a child's throat. When this toxin enters the living body, the body cells react by secreting an antidote or antitoxin. If sufficient antitoxin is formed soon enough, the child recovers, if not, it dies. Too often the antitoxin formed is insufficient, and the child is overwhelmed by the poison; or the membrane formed on the throat owing to the irritation of the toxin spreads into the air passages and the child is choked. By injecting gradually increasing doses of anatoxin (we will explain this word presently) under the skin of a horse, this animal, while remaining in good health, secretes so much antitoxin, that a small quantity of its serum injected under the skin of a sick child, before it is too late, will neutralise the toxin and save the child's life. If every case of diphtheria were recognised within the first two days, and the remedy used promptly, deaths would be extremely few. Unfortunately, the disease will never be always recognised within the first two days, and with each additional day the death rate rises. Antitoxin has greatly reduced the death rate from diphtheria in Queensland, but there are still many deaths. Although the deaths from diphtheria are less numerous, the number of cases of diphtheria are no less, indeed, they may be more numerous. Antitoxin will save the individual patient, it does nothing to prevent the epidemic. We have saved many lives, but we have failed to prevent diphtheria.

It was hoped that by swabbing the throats of all contacts with diphtheria cases, examining the swabs for diphtheria bacilli, and isolating all carriers as well as patients until three negative swabs at forty-eight hours intervals have been obtained, epidemics might be prevented. This policy may have done some good, but after a fair trial it may fairly be said to have failed to prevent the disease. The reasons are simple. As a matter of practice it is impossible to get hold of all diphtheria carriers, and even thirty "negative swabs" would not be conclusive evidence of the absence of diphtheria bacilli. Furthermore, a large proportion of

the bacilli so discovered are not virulent, and to test all the samples of virulence is scarcely practicable. If all children were trained to keep their fingers out of their mouths and away from their noses, there would be less diphtheria. But such a result would entail many years, or several generations, of education, and even then no absolute safety would be secured.

Our Search for Safety.

In our search for safety we must study the natural history of the disease. If an exceedingly minute quantity of diphtheria toxin be injected into the skin a small area of inflammation follows in those who are susceptible to diphtheria, but no inflammation follows in those who are immune. This is known as the Schick test. In young infants the proportion that react to the test is small. Most of them have derived some antitoxin from their mother's blood, and perhaps some from their mother's milk. From one to three years of age all react—they are all susceptible. Each year after that the percentage that reacts becomes smaller, and after fourteen years it is again low. Between three and fourteen years almost all children have absorbed some diphtheria poison, and most of them become gradually immunised. But in a proportion of these children either from great natural susceptibility, or a massive dose of infection, or a temporary weakening of resistance from a "cold," a tonsilitis, or other infection, there results an acute and dangerous illness. Of recent years we have been able to immunise susceptible, that is "Schick-positive" children. By a simple chemical process diphtheria toxin can be made harmless, without losing its protective power. After two injections of this "anatoxin," as it is called, about 90 per cent. of susceptible children have been made immune, after three injections 98 or 99 per cent.

Prevention of Diphtheria.

It is now possible to prevent diphtheria. It can be prevented at any age. During the first year of life preventive inoculation is under ordinary circumstances hardly necessary. From two to five years of age the death rate from diphtheria is highest and, consequently, the best time for immunisation is during the second and third years. But many children remain susceptible during school age, as indicated by the "Schick test," and for them also immunisation is advisable. Parents will naturally and rightfully inquire—

(1) Is it safe?

(2) What degree of protection will it give?

As to (1), we may say that over half a million children have been immunised, and that accidents have been extremely rare. With our newest methods no serious accidents have occurred. Those that have occurred have been profoundly sad, but in each case the cause of the accident has been discovered, and that it should occur again is nearly impossible. Our methods have much improved. As to (2), we must answer that the protection does not appear immediately, but that it is acquired to some extent within fifteen days of the first injection. The protective value of one injection is, however, insufficient. After three injections the protection given is very great, though not absolute. We have good evidence that it lasts for four years, probably it lasts from six to ten years. It should reasonably be expected to protect children throughout the susceptible period under ordinary conditions.

THE WOMAN ON THE LAND.

By F. O. BOSWORTH, B.A., Queensland Agricultural High School and College.*

DOMESTIC AMENITIES.

IN recent years much attention has been directed to the importance of hygiene in rural industry. By legislation and otherwise progress is being steadily made in the provision of healthy conditions for both man and beast. To the farmer regulations are sometimes irksome at first, but later he recognises their benefits and wonders how he carried on without the improvements effected under them. Probably there is no more conservative class in the community than the farmer. This is not to be wondered at, for his work is by nature a more or less regular routine. Ploughing, harrowing, planting, cultivating, garnering, milking, separating, cleaning utensils, cutting fodder, milking again and so on in the eternal round, follow one another as certainly as night follows day. His work is ordained for him and that done he retires to his downy couch without thought of alteration either in

* In a Radio Address through 4QG.

routine or crop. He wakes up one day to the fact that repairs are needed on some of his buildings—he wants new implements, in fact everything outside the house seems to have conspired to irritate him. The house alone seems to need nothing. His patient wife appears tired at night, but she has done so for years. The kitchen is still hot and on washing days the clothes hang on the line as usual. Everything seems all right and the wife carries on under conditions that would not be tolerated for five minutes by hired labour. "Keeping house" in the country is made one of the worst of jobs, when it should be, viewed in the right spirit, one of the best. Living on the land seems to engender with some people a domestic indifference that is fatal to all refinement and crushes out that vigorous womanliness that was so noticeable when the bride first crossed the threshold. Now, need this be? Are we bound to suppress all culture and refinement in the country? To these questions we, of course, give an emphatic "No."

Much may be done to lighten the burden of manual labour. Progress in civilisation may be judged by the amount of reduction in manual work. To what extent, it may be asked, has the actual manual labour of the farmer's wife been reduced during the last twenty years?

Comfort in the Kitchen.

Factories in which men and women work for eight hours a day at the maximum must satisfy stringent building regulations, and the equipment must be of a high standard. If the work can be accomplished by sitting down, then suitable chairs or stools must be provided. If the work is performed standing up then the height of the table is regulated to the least tiring position. When it comes to the house these provisions are often entirely neglected and no thought whatever is given to making the housewife's working conditions equally favourable. Compare them—eight hours a day in a factory under good conditions, with rest rooms and so forth, and sixteen hours a day in a house, the greater part of the time spent in an ill-equipped kitchen!

However, under the influence of organisations like the Country Women's Association and the Town and Country Women's Club, we are awakening to a fuller realisation of the situation. The general trend of their activities is towards improving the working conditions of the woman on the land, and the general social amenities of country life.

In Queensland, the climatic conditions call for large, well ventilated rooms so that the detached kitchen and living room combined seems to be the ideal arrangement. The advantages to be gained by this arrangement are:—

(1) Provision can be made for windows and doors on both sides to permit of cross ventilation.

(2) The housewife's movements are minimised when preparing meals.

(3) One room only needs cleaning up after each meal.

(4) The increased size of the room means a greater degree of coolness.

If preferred, the kitchen may be smaller with an alcove for dining. Equipment in the kitchen should be grouped to avoid unnecessary work. One square foot of glass area to five or six square feet of floor space in the kitchen will give ample light. The windows should be placed so as to allow of cross ventilation when open. Two small windows, capable of opening, one or either side of the stove recess will be found of great convenience, for they not only shed light in the darkness, but will carry off many of the fumes associated with cooking.

Too frequently our kitchens are mere shells. The outside wall whether of wood or iron forms the inside wall of the kitchen while the rough studs, rafters, and roof remain uncovered, forming a harbour for insect pests and dust. A lining on the inside adds to the attractiveness of the room, facilitates cleaning, and provides a desirable insulating air space and a cooler kitchen. A piece of concave moulding at the junction of the floor and wall and under which the linoleum can just pass will cut off corners in which dirt and dust usually accumulates.

Work is pleasant or unpleasant according to the mental attitude towards it, and the housewife will feel more contented and less tired if she works in a kitchen attractively painted and capable of being kept clean. The Americans have carried the equipment of kitchens to a fine art. They believe in plenty of cupboard space. Usually these cupboards are built into the walls, but it is doubtful if this arrangement would be satisfactory in Queensland owing to the possible invasion of ants and cockroaches which find harbourage in obscure corners and inaccessible grooves. Rags soaked in a solution of mercuric chloride and tied round the legs of dressers

and safes will keep out ants. One soaking will serve for three months. This solution is poisonous, so every care must be taken in its use. Cockroaches will eat almost anything. To get rid of them, a saucer containing dry plaster of Paris and another containing water is usually effective. The pest eat the plaster, becomes dry, then drinks the water and dies. Sodium fluoride sprinkled round their haunts will also rid the house of them. That is by way of digression.

To return to the kitchen equipment: Every kitchen should be provided with a sink, with running water and a suitable means of carrying away waste water. It is believed that this will be found the greatest labour saver among all the single pieces of equipment. When the sink has drain boards or work shelves on either side its usefulness is further increased. To get this convenience the house supply would, of course, have to be placed on high blocks. Experience will show whether it is necessary to have two tanks or one to supply kitchen needs. The carrying of all water up high steps is a wearying job, and no woman should be expected to do it, especially when we consider that a gallon of water weighs ten pounds. The enormous saving of time and energy by having a water tap inside the kitchen can readily be calculated.

The correct height for a working surface will depend upon the height of the worker and the nature of the work. A working surface with a height equal to one-half the worker's height is good for practically any kind of kitchen work. Constant bending down to a low height may in the long run result in serious physical disabilities. This is a matter, the importance of which has not yet been generally realised. When we consider that our housewives are also the mothers of future Australians we can realise that everything should be done to ensure the proper functioning of all here physical processes.

Household Pests.

In many parts of the country summer brings with it a plague of flies. It is to the kitchen that these disease carriers resort. Food has an attraction for them and once they get into the house they are not only an irritant to human beings, but are filthy in the extreme. Provision should be made to put all kitchen utensils behind closed doors. Glass doors on the dresser are preferable to wood, as the light prevents insects such as silverfish and cockroaches from staying there long. Where flies are bad, fly screens inexpensively made, should be placed over all open spaces and so provide a fly-proof kitchen. Working under such conditions is more congenial, irritation is reduced, health will not be affected, and the kitchen will be much cleaner.

This kitchen problem seems to be a tall order, but the health and comfort of the housewife is the first consideration, for upon her efficiency depends the efficiency of the rest of the household.

The Bathroom and the Laundry.

How many farms are there equipped with a bathroom and a laundry? Speak to the farmer about such things and he will tell you that he cannot afford the water. It would be more strictly true to say that sufficient rain falls, but that insufficient storage capacity is provided. In the wet season tanks frequently overflow and the water thus lost would more than provide for all laundry and bathing purposes. Here again the tanks must be perched on high blocks to provide the necessary fall. One finds often that the washing is done out in the sun; all water has to be lifted into the tubs and then the tubs emptied afterwards. All this labour could be obviated by a tank on high blocks fitted with a pipe and a tap over each tub. Where the house is on high blocks a laundry can be fitted up underneath. Concrete tubs set on to a bench of convenient height, with a waste water-pipe, saves a tremendous amount of unnecessary heavy manual toil; the cost of such convenience is comparatively small. As for the boiling arrangements, kerosene tins may serve, but a closed fire under a proper copper, situated close to the washing tubs, is much more economical on wood and human labour. Even if we eliminate the concrete tubs and have the tap over a bench of convenient height we shall eliminate much useless drudgery.

The enamel basin or half kerosene tin under the tap of the tank may be useful for cleansing the face and hands, but no person can be healthy without a regular bath. A small enclosure with a concrete floor can be made under the house and a length of piping from the tank will provide all that is necessary for bodily cleanliness—hence no more upsetting of other rooms, no more carrying of water and all the mess confined to one spot—less cleaning up, less work, more comfort and greater peace of mind.

When one considers the advantages and the low initial cost with which these necessites can be carried out by a handy man, the wonder is that people put up with primitive arrangements so long. A farmer who employs labour is compelled by law to provide these necessary conveniences, and yet they are not regarded as necessaries for his own household.

If the house were the limit of woman's activities her lot could be made reasonably happy, but when she has to take her turn in the dairy, manage the poultry, look after the kitchen garden and, perhaps, help in the field, we can understand why there is a disinclination for farmer's daughters to remain on the land. Anything that can be done to improve her conditions of life will do much to compensate for, possibly, the lack of other amenities. Love in a cottage may last, but it is doubtful if it will withstand many years of rude shocks and jars.

THE OCCURRENCE OF CANCER.

HOW ITS INCIDENCE CAN BE REDUCED.

Among the uses to which wireless telephony is put is the broadcasting throughout a nation or continent information of value alike to the individual or the community, irrespective of time or distance. "Public education," declared a leading medical authority at a recently held meeting at Brisbane of the Town and Country Women's Club, "in essential cancer facts, coupled with periodic medical examination, will go a long way towards reducing the incidence of cancer and the death rate from the disease." This informative address was broadcast throughout the State simultaneously with its delivery.

The term "cancer," said this medical authority, was synonymous with malignancy and connected a group of diseases characterised by the apparently causeless but progressive and persistent growth of the cells of a particular tissue in the human body. The doctor also adverted to the mystery surrounding the origin of the disease in any of its manifold forms, emphasising the fact that every cancer—and there were dozens of varieties—originally sprang from what was a normal cell or group of cells in the human body. Cancer in its first manifestation seemed to have its origin in a distorted type of growth assumed by a cell, or possibly a group of neighbouring cells, in an area which had been subjected for a longer or shorter period to some form of chronic irritation. In most cases the cells took on an abnormal tissue growth, which multiplied rapidly and formed the tumour mass.

The lecturer then explained that this tumour in its early stages was a purely local condition, but sooner or later, depending on its site, type, and rate of growth, cells broke away from the parent body, and, travelling by the blood and lymphatic vessels, were transported to distant organs, where they in turn multiplied and formed secondary growths, in the brain, lungs, spine and liver, for instance. It was usually from the inroads of those growths that the victims died. This served to show, the lecturer urged, the necessity for treating cancer in its local stage.

Giving instances of types of cancer, the lecturer said that certain types were associated with certain occupations, and were thus known as occupational or industrial cancer. For instance, there was a malignancy that affected the hands and forearms of cotton spinners using a certain type of lubricating oil on spinning machines.

He urged the necessity of submitting to an examination by a competent medical authority at the first indication of a suspicious growth, or even a superficial irritation which seems to be permanently established.

"Unfortunately," the lecturer went on to say, "the majority of patients, whether through fear or ignorance, or both, avoided seeing their doctors until the disease had become so widespread that a permanent cure was out of the question."

Throughout the civilised world investigation is continuously and persistently going on as to the origin and incidence of this dread disease. Until a few years ago the only treatment available was the removal of the tumourous growth by the surgeon's scalpel. Now, however, as the outcome of the unceasing physical research carried out the world over by doctors and surgeons we are able to call in the assistance of radium and the deep X-ray, which is to-day available in Brisbane and in other big cities of the State, and it is gratifying to know that these weapons against cancer will ultimately be installed in every public hospital of Queensland, and indeed

throughout the Commonwealth. But after all it is only by a campaign of public education that the disease will be mastered, and the fact must be persistently and continuously emphasised that if a cure is to be effected scientific treatment must be resorted to at the earlier stages of the disease.

TOPICAL NOTES.

Farm Life.

A Singleton (N.S.W.) farmer, Mr. Harry Wright, in the course of a paper read by him at the annual conference of his district Agricultural Bureau, had this to say on the necessity of making farm life profitable and happy:—Farming conducted on the right lines was the most independent and happy life that could be selected, and a mixed farm could be started in a small way without much capital, provided plenty of will power, common sense, and energy were put into the job. The working together of the members of the family put the farmer in a better position than any other tradesman.

Dairying, Mr. Wright considered a safe occupation to follow as a basis on which to build a mixed farm. Choice of suitable land, of good types of cattle, and the adoption of good business methods were stressed as essential to success, while a comfortable home with pleasant surroundings was important. Pig-raising was a good adjunct to dairying, but the farmer should ensure that he raised attractive pigs of the type desired by buyers. Poultry, fruit, bees, and vegetables were also good sidelines.

The adoption of up-to-date methods was important, and farmers and their families should join up with the Agricultural Bureau for educational, economic, and social benefits. Junior farmers' clubs to help in the scientific training of youths on the land should be encouraged. It was necessary to instil into the boys what a healthy and happy life the man on the land leads as the creator of new wealth.

In conclusion, Mr. Wright stressed the duty of parents in relation to keeping their children on the farms, by making their lives not only attractive but profitable.

The Medicine Chest.

Every home should have a measuring glass for medicines, so that the inmates shall not have to rely on teaspoons and tablespoons for measuring purposes.

The best "safety first" maxims are those concerning the medicines chest. Every mother should read the following suggestions:—

Keep all medicines together in one cupboard.

Never take medicine in the dark.

Always look at the label and read the directions before taking a dose of medicine.

Never increase the dose, or take it more frequently without consulting your physician if it is taken under his orders.

Pour from the bottle with the label upward. This keeps the label clean and legible.

Never take prescription medicine originally intended for others; the drugs it contains may be entirely unsuited for your condition, and be actually harmful.

Capsules, pills, and tablets should always be taken with a few swallows of water, unless otherwise directed by your physician.

Keep medicine out of reach of children; keep the cupboard locked, if possible.

Keep capsules, pills, and tablets in a dry place—moisture may spoil them.

Always keep medicine bottles, boxes, jars, or tubes tightly corked, or with the tops securely on.

Keep ointments and salves securely closed, and in a cool place.

Never interchange tops or covers on pill or powder boxes if they bear directions regarding use. Dangerous results may occur.

After using an eye water in an eye cup, do not pour it back into the bottle, as this is apt to contaminate the preparation.

MANURE FOR CABBAGES.

To grow cabbages well plenty of manure should be used. There is no manure to which this crop responds so well as animal. For heavy lands horse manure, and for light soils cow or pig are respectively the best when they can be obtained. If the soil is of a poor quality, dig the ground two spits deep,. and put a good layer of manure between the two spits. This is especially necessary in the case of autumn or summer crops, which have to stand a dry spell. Spring cabbage—that is, those that are planted in the autumn for use in the spring—do well if planted on ground that has been well worked and manured previously for peas or onions, and on such ground cabbages can be planted without any fresh manure being added. Of other manures lime is an important factor in successful cabbage culture; it is chemically and mechanically beneficial to the soil, and the cabbage tuber. It should be applied at the rate of about 2 lb. to the square yard, and is particularly necessary to heavy soils and those rich in humus. Superphosphate at the rate of 2 oz. to the square yard is good, but should not be applied at the same time as lime or to soils that are infected with club root. When the crop is nicely established, apply 1 oz. of sulphate of ammonia to heavy, damp land, or 1 oz. of nitrate of soda per square yard in the case of light or sandy soil. Nitrate of soda is a splendid fertiliser for the cabbage family. When especially fine heads are required, water the plants once or twice during the growing season with the following mixture:—1 oz. of iron sulphate and 2 oz. of sulphate of ammonia dissolved in 1 gallon of water.

KITCHEN GARDEN.

Now is the time when the kitchen garden will richly repay all the labour bestowed upon it, for it is the month for sowing many kinds of vegetables. If the soil is not naturally rich, make it so by a liberal application of stable manure and compost. Manure for the garden during summer should be in the liquid form for preference. Failing a sufficient supply of this, artificials may be used with good results. Dig or plough the ground deeply, and afterwards keep the surface in good tilth about the crops. Water early in the morning or late in the evening, and in the latter case stir the soil early next day to prevent caking. Mulching with straw, leaves, or litter will be a great benefit as the season becomes hotter. It is a good thing to apply a little salt to newly-dug beds. What the action of salt is is not exactly known, but when it is applied as a top dressing it tends to check rank growth. A little is excellent for cabbages, and especially for asparagus, but too much renders the soil sterile and causes hardpan to form. French or kidney beans may now be sown in all parts of the State. The Lima bean delights in the hottest weather. Sow the dwarf kinds in drills 3 ft. apart and 18 in. between the plants, and the climbing sorts 6 ft. each way. Sow Guada beans, providing a trellis for them to climb on later. Sow cucumbers, melons, marrows, and squash at once. If they are troubled by the red beetle, spray with Paris green or London purple. In cool districts peas and even some beetroot may be sown. Set out egg plants in rows 4 ft. apart. Plant out tomatoes 3½ ft. each way, and train them to a single stem, either on stakes, trellis, or wire netting. Plant out rosellas. Sow mustard and cress, spinnach, lettuce, vegetable marrows, custard marrows, parsnips, carrots, chicory, eschalots, cabbage, radishes, kohl-rabi, &c. These will all prove satisfactory provided the ground is well worked, kept clean, and that water, manure, and, where required, shade are provided.

FIVE REASONS IN FAVOUR OF THE HOME VEGETABLE GARDEN.

(1) Fresh vegetables, especially vegetables containing vitamines, are essential to good, robust health, and medical men are now advising people to "eat more vegetables."

(2) The growing of vegetables not only means a saving of money, but educates the children by inculcating a desire to have their own gardens in later life, and so help to keep down the costs of living.

(3) Vegetable-growing is not only a healthy occupation, but it also provides exercise and recreation. In the suburbs it has a tendency to keep young people contented at home, and to trouble less about going to horse races and places of gambling. With country people who, perhaps, are less in need of exercise, gardening is a delightful hobby.

(4) It enables private gardeners to improve the strains of vegetables by a careful selection of seed, much in the same way that a flockmaster improves his sheep; and much satisfaction, and not unusually generous reward are to be gained from this work.

(5) The home garden enables the testing out, in a small way, of the newer varieties of vegetables, which work is not always possible, or, if it is possible, not payable with the professional or commercial gardener. The amateur gardener will find this work both fascinating and health-giving.

Farm Notes for September.

With the advent of spring, cultivating implements play an important part in farming operations.

The increased warmth of soil and atmosphere is conducive to the growth of weeds of all kinds, particularly on those soils that have only received an indifferent preparation.

Potatoes planted during last month will have made their appearance above the soil, and where doubt exists as to their freedom from blight they should be sprayed with either Burgundy or Bordeaux mixture as soon as the young leaves are clear of the soil surface.

Land which has received careful initial cultivation and has a sufficiency of subsurface moisture to permit of a satisfactory germination of seeds may be sown with maize, millets, panicum, sorghums, melons, pumpkins, cowpeas, broom millets, and crops of a like nature, provided, of course, that the areas sown are not usually subjected to late frosts.

Rhodes grass may be sown now over well-prepared surfaces of recently cleared forest lands or where early scrub burns have been obtained, and the seed is sown subsequent to showers. More rapid growths, however, are usually obtainable on areas dealt with, say, a month later.

In connection with the sowing of Rhodes grass, farmers are reminded that they have the Pure Seeds Act for their protection, and in Rhodes grass, perhaps more than any other grass, it is necessary that seed of good germination only should be sown. A sample forwarded to the Department of Agriculture will elicit the information free of cost as to whether it is worth sowing or not.

Where the conditions of rainfall are suited to its growth, paspalum may be sown this month.

The spring maize crop, always a risky one, requires to be sown on land which has received good initial cultivation and has reserves of soil moisture. Check-row seeding in this crop is to be recommended, permitting as it does right-angled and diagonal cultivation by horse implements, minimising the amount of weed growth, and at the same time obtaining a soil mulch that will, with the aid of light showers, assist to tide the plant over its critical period of "tasselling."

Although cotton may be sown this month, it usually stands a better chance if deferred until October. The harvesting of cotton during the normal rainy season is, if possible, to be avoided.

The sowing of intermediate crops prior to the preparation of land for lucerne sowing should be carried out in order that early and thorough cultivation can take place prior to the autumn sowing.

The following subsidiary crops may be sown during the month:—Tobacco and peanuts; plant sweet potatoes, arrowroot, sugar-cane, and cow cane (preferably the 90-stalked variety), and in those districts suited to their production yams and ginger. Plant out coffee.

THE FARM GARDEN

It is not necessary to discuss whether the vegetable garden or the flower garden is the more valuable; we ought to take it for granted that both are essential to the complete country home. Fresh, succulent vegetables, full of vigorous vitamins, and appetising with a thousand precious ethers, make the farm table something that city folk can barely imagine.

Yet man shall not live by bread alone, and if we need vegetables for our bodies we equally need flowers for our souls—for that aesthetic hunger for the beautiful that is inherent in all of us.

Vegetable-growing is usually the task of those members of the farm household whose ordinary occupation is not laborious, muscle-straining work on the farm; and to them it represents exercises, recreation, stimulation of the bodily functions, and health.

For the younger members of the family vegetable-growing provides education in soil science, in cultural lore, in the elements of breeding, as well as in those qualities of the mind that are stiffened by adversity and nourished by success. There are pests to fight, frosts to guard against, air and water to put into the soil, and all the processes of nature to assist.

And vegetable eating is the cure for many disorders, and the proved preserver of health. Furthermore, the vegetable garden is the soil in which the herb "thrift" thrives most vigorously. A productive vegetable patch shrinks the store bill, and doctors' and chemists' bills. It does ever so much more—it trains the young people in ways of health and ways of thrift, in which they will walk all their lives. Every farm should have both a vegetable and a flower garden book, to be able to supplement all the family knowledge of gardening, and as a reminder of what to sow and when to sow it.

Economists tell us that the fault of Australian agriculture is that it tends too much to specialise in one crop or other product, and thus the farmer is up against it when prices of his staple are low. There are sidelines that the farmer with spare labour and spare capital might wisely take up; but there is one sideline that calls for practically no capital, and for only spare-hour labour—the vegetable garden. And though vegetables may not bring much hard cash on to the farm, they will prevent a fairly considerable sum from going out.

Some farmers are rather contemptuous about vegetable gardening. Let such a one agree to fence, plough, and manure a quarter of an acre and pass it over to mother and the girls to make what they can of it. Let him agree to purchase all the vegetables needed for the farm table at current rates, and to market the surplus for his women-folk.—"The Country Woman."

Orchard Notes for September.

THE COASTAL DISTRICTS.

September is a busy month for the fruitgrowers in the coastal districts of this State, as the returns to be obtained from the orchards, vineyards, and plantations depend very largely on the trees, vines, and other fruits getting a good start now.

In the case of citrus orchards—especially in the southern half of the State—it is certainly the most important month in the year, as the crop of fruit to be harvested during the following autumn and winter depends not only on the trees blossoming well but, what is of much more importance, that the blossoms mature properly and set a good crop of fruit.

This can only be brought about by keeping the trees healthy and in vigorous growth, as, if the trees are not in this condition, they do not possess the necessary strength to set their fruit, even though they may blossom profusely. The maintenance of the trees in a state of vigorous growth demands—first, that there is an adequate supply of moisture in the soil for the requirements of the trees; and, secondly, that there is an adequate supply of the essential plant-foods available in the soil.

With respect to the supply of moisture in the soil, this can only be secured by systematic cultivation, except in seasons of good rainfall or where there is a supply of water for irrigation. As a rule, September is a more or less dry month, and when it is dry there is little chance of securing a good crop of fruit from a neglected orchard.

If the advice that was given in the Notes for August regarding the conservation of moisture in the soil has been carried out, all that is necessary is to keep the soil stirred frequently, so as to prevent the loss of moisture by surface evaporation. If the advice has been ignored, then no time should be lost, but the soil should be brought into a state of good tilth as quickly as possible.

Where there is a supply of water available for irrigation, the trees should receive a thorough soaking if they require it. Don't wait till the trees show signs of distress, but see that they are supplied with an adequate supply of moisture during the flowering and setting periods.

It is probable that one of the chief causes why navel oranges are frequently shy bearers in the coastal districts is that the trees, though they produce a heavy crop of blossoms, are unable to set their fruit, owing to a lack of sufficient moisture in the soil at that time, as during seasons when there is a good rainfall and the trees are in vigorous growth, or where they are grown by irrigation, as a rule they bear much better crops. The importance of maintaining a good supply of moisture in the soil is thus recognised in the case of this particular variety of citrus fruit.

When the trees show the want of sufficient plant-food—a condition that is easily known by the colour of the foliage and their weakly growth—the orchard should be manured with a quick-acting, complete manure, such as a mixture of superphosphate, sulphate of ammonia, and sulphate of potash, the plant-foods which are soluble in the water contained in the soil and are thus readily taken up by the feeding roots.

Although the above has been written mainly in respect to citrus orchards, it applies equally well to those in which other fruit trees are grown. Where the land has been prepared for bananas, planting should take place during the month. If the plantation is to be made on old land, then the soil should have been deeply ploughed and subsoiled and brought into a state of perfect tilth prior to planting. It should also receive a good dressing of a complete manure, so as to provide an ample supply of available plant-food. In the case of new land, which has, as a rule, been scrub that has been recently fallen and burnt off, the first operation is to dig the holes for the suckers at about 12 ft. apart each way. Good holes should be dug, and they should be deep enough to permit the top of the bulb or corm of the sucker to be 6 in. below the surface of the ground.

Care should be exercised in the selection of suckers, butts, or bits. Either of the two latter are preferable, and in the case of suckers which have broken into leaf, these should also be cut hard down to the butt. Before planting all roots should be cut off closely and the surface pared or scraped, excepting over the buds or eyes which are allowed for development. Where the butts are split into sections (up to four) according to the number and placements of eyes, these are planted with the eye or eyes facing downwards. In the case of butts, 2 to 3 eyes are left spaced around the butt, any surplus ones being removed. The top having previously been cut down to the corm and the centre scored out. Better growth is evidenced in each case, and as no cut surface is made available (each "plant" being covered by a few inches of soil immediately) beetle borer infestation is not shown.

In old banana plantations keep the ground well worked and free from weeds and remove all superfluous suckers; also all bases of plants which have fruited.

When necessary manure—using a complete fertiliser rich in potash, nitrogen, and phosphoric acid, such as a mixture of meatworks manure and sulphate of potash —2 of the former to 1 of the latter.

Pineapples can also be planted now. The ground should be thoroughly prepared —viz., brought into a state of perfect tilth to a depth of at least 1 ft.—more if possible—not scratched, as frequently happens; and when the soil requires feeding, it should be manured with a complete manure, which should, however, contain no superphosphate, bonedust or Nauru phosphate being preferable.

Old plantations should be kept in a good state of tilth and be manured with a complete fertiliser in which the phosphoric acid is in the form of bonedust, basic phosphate, or finely ground phosphatic rock, but on no account as superphosphate.

The pruning of custard apples should be carried out during the month, leaving the work, however, as late in the season as possible, as it is not advisable to encourage an early growth, which often means a production of infertile flowers. If the weather conditions are favourable passion vines can also be pruned now, as if cut back hard they will make new growth that will bear an autumn crop of fruit instead of one ripening during the summer.

Grape vines will require careful attention from the time the buds start, and they should be regularly and systematically sprayed with Bordeaux mixture from then till the time the fruit is ready to colour, in order to prevent loss by downy mildew or anthracnose. Sulphuring may be required against powdery mildew.

Where leaf-eating beetles, caterpillars, or other insects are present, the trees or plants on which they are feeding should be sprayed with arsenate of lead. All fruit-fly infested fruit must be gathered and destroyed and on no account be allowed to lie about on the ground, as, if the fly is allowed to breed unchecked at this time of the year, there is very little chance of keeping it in check later in the season.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

Where not already completed, the winter spraying with lime-sulphur should be finished as early in the month as possible. Black aphis should be fought wherever it makes its appearance by spraying with a tobacco wash, such as black-leaf forty, as if these very destructive insects are kept well in hand the young growth of flowers, leaves, wood, and fruit will have a chance to develop.

The working over of undesirable varieties of fruit trees can be continued. The pruning of grape vines should be done during the month, delaying the work as long as it is safe to do so, as the later the vines are pruned the less chance there is of their young growth being killed by late frosts. Keep the orchards well worked and free from weeds of all kinds, as the latter not only deplete the soil of moisture but also act as a harbour for many serious pests, such as the Rutherglen bug.

New vineyards can be set out, and, in order to destroy any fungus spores that may be attached to the cuttings, it is a good plan to dip them in Bordeaux mixture before planting. The land for vines should be well and deeply worked, and the cutting should be planted with one eye only out of the ground and one eye at or near the surface of the ground.

In the warmer parts which are suitable for the growth of citrus fruits, the land must be kept well cultivated, and if the trees need irrigating they should be given a good soaking, to be followed by cultivation as soon as the land will carry a horse without packing.

In these parts fruit fly should be systematically fought, as it will probably make its appearance in late citrus fruits and loquats; and if this crop of flies is destroyed, there will be every chance of the early crops of plums, peaches, and apricots escaping without much loss.

SUBSCRIPTIONS TO THE JOURNAL.

Subscribers are reminded that when a cross is placed in the square on the first page of the Journal it is an indication that the term of their subscription ends with the number so marked, and that it is advisable to renew immediately if they desire the retention of their names on our mailing list.

To farmers, graziers, horticulturists, and Schools of Art the annual subscription—one shilling—is merely nominal, and the charge is only imposed to cover the cost of postage. To them, otherwise, it is an absolutely free issue. Members of agricultural and similar societies who are not actively engaged in land pursuits are asked to pay five shillings a year, while the annual subscription charged to the general public is ten shillings.

Farmers particularly are urged to keep their names on our mailing list, for through the Journal they may keep themselves well informed in respect to the activities of the Department, and other matters with which they are directly concerned. Instead of sending just the annual subscription along it is suggested that, when renewing it, they do so for a longer term. For instance, five shillings would keep their names on our subscribers' register for five years. By doing this they would obviously help to reduce clerical labour as well as avoid the inconvenience to themselves of posting annually the very small sum necessary to keep their names on our mailing list.

On another page an order form may be found, and for those whose annual subscription is about due what is wrong with filling it up now and posting it direct to the Under Secretary, Department of Agriculture and Stock?

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	August, 1930.		September, 1930.		MOONRISE. Aug., 1930.	Sept., 1930.
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6.37	5.19	6.10	5.34	10.50	11.29
						p.m.
2	6.36	5.20	6 9	5.34	11.25	12.21
3	6.36	5.20	6 8	5.35	12.0	1.14
					p.m.	
4	6 35	5.21	6.7	5 35	12.43	2.8
5	6.34	5.22	6.6	5.36	1.33	3.5
6	6.33	5.23	6.5	5.36	2.25	4.0
7	6.33	5.23	6.4	5.37	3.19	4.53
8	6.32	5.24	6.3	5.37	4.13	5.47
9	6.31	5.24	6.2	5.38	5 8	6.39
10	6.30	5.25	6.0	5.38	6.4	7.31
11	6 29	5.25	5.59	5.39	6.52	8.25
12	6.29	5.26	5.58	5.39	7.50	9.21
13	6.28	5.26	5.56	5.40	8.42	10.22
14	6.28	5.27	5.55	5.40	9.34	11.23
15	6.26	5.27	5.54	5.41	10.27	...
						a.m.
16	6.25	5.28	5.53	5.41	11.27	12.25
17	6.24	5.28	5.52	5.42	...	1.27
					a.m.	
18	6.23	5.29	5.51	5.42	12.27	2.28
19	6.22	5.29	5.50	5.43	1.31	3.24
20	6.21	5.30	5.48	5.43	2.34	4.12
21	6.20	5.30	5.47	5.43	3.39	4.53
22	6.19	5.31	5.46	5.43	4.41	5.30
23	6.18	5.31	5.45	5.44	5.35	6.9
24	6.17	5.32	5.44	5.44	6.21	6.40
25	6.16	5.32	5.43	5.45	7.2	7.14
26	6.15	5.32	5.42	5.45	7.36	7.53
27	6.14	5.33	5.40	5.46	8.11	8.34
28	6.13	5.33	5.39	5.46	8.45	9.21
29	6.12	5.33	5.38	5.47	9.19	10.16
30	6.11	5.34	5.37	5.47	9.57	11.7
31	6 10	5.34	...	...	10.40	...

Phases of the Moon, Occultations, &c.

1 Aug.	☾ First Quarter	10	26 p.m.
9 „	○ Full Moon	8	58 p.m.
17 „	☽ Last Quarter	9	31 p.m.
24 „	● New Moon	1	37 p.m.
30 „	☾ First Quarter	9	57 a.m.

As Mercury will be at its greatest distance, 27 degrees, east of the Sun on the 25th, it will be at that distance above the western horizon when the Sun sets. Though the brilliance of its disc will be less than one-half of the maximum amount, it will afford a favourable opportunity for observation when the daylight has sufficiently faded. Venus, being 17 degrees higher up and somewhat to the south, will, of course, be much more noticeable.

On the 27th, the Sun will be slowly passing from west to east of Neptune, but more than half a degree further south, Neptune being about 2,800 million miles beyond it.

Mercury will set at 6·37 p.m. on the 1st and at 7·19 p.m. on the 15th.

Venus will set at 8·31 p.m. on the 1st and at 8·49 p.m. on the 15th.

Mars will rise at 2·46 a.m. on the 1st and at 2·32 a.m. on the 15th.

Jupiter will rise at 4·38 a.m. on the 1st and at 3·55 a.m. on the 15th.

Saturn will rise at 2·50 p.m. and set at 4·32 a.m. on the 1st; on the15th it will rise at 1.52 p.m. and set at 3·27 a.m.

When the Southern Cross comes into view after sunset on the 1st it will be bending downwards, slightly to the right, about 10 degrees west of the southern meridian. At the end of the month it will be much more noticeably inclined, and about 10 degrees further west.

8 Sept.	○ Full Moon	12	47 p.m.
16 „	☽ Last Quarter	7	12 a.m.
22 „	● New Moon	9	41 p.m.
30 „	☾ First Quarter	12	57 a.m.

Apogee, 6th September, at 7.54 a.m.
Perigee, 21st September, at 2.54 p.m.

Soon after sunset on the 2nd it will be noticeable that the Moon and Saturn will both be very high overhead, the Moon being almost in the zenith at Warwick, and Saturn 6 degrees (the length of the Southern Cross) northward of it. Saturn, which was apparently moving slowly westward amongst the stars of Sagittarius, since the end of April will, like the Sun on 22nd June, seem to stop and retrace its steps, which it will continue to do till the end of the year when it will reach the same position it held about 1st May.

Venus will reach its greatest elongation, 46 degrees east of the Sun, on the 12th. It will remain upon the western horizon until after 9 o'clock, and its brilliance will continue to increase for another month.

Mercury will be passing from east to west between Earth and Sun on the 21st, but a transit will not occur, Mercury passing about 3 degsees south of the Sun.

The Sun will reach the equinoctial point, crossing the celestial equator at 4.36 a.m., on the 24th when there will be 12 hours night and 12 hours day.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.